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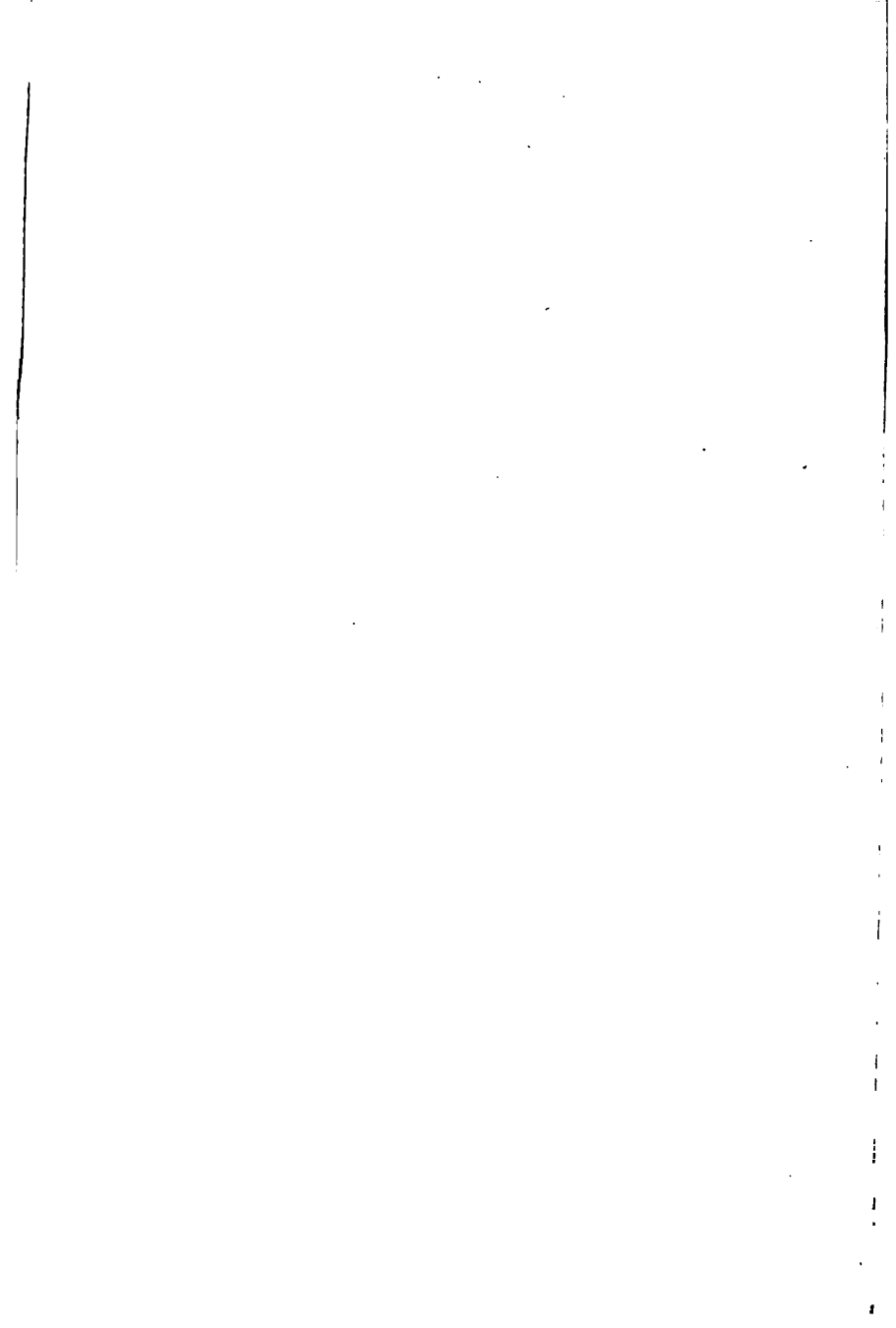
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The Brevity Book on
PSYCHOLOGY



The Brevity Book on PSYCHOLOGY

By

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PREFACE

This book attempts to present in a small compass the essential principles of psychology. The author hopes, however, that this brief text will invite the reader to follow a more extensive course of study in the subject. The book is further designed to give those who have either no access to the larger works or little time to devote to them, an adequate review of the science as currently interpreted by representative psychologists.

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Urbana, Illinois
October 20, 1919

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The Brevity Book on PSYCHOLOGY

CHAPTER I

INTRODUCTION

1. NATURE OF PSYCHOLOGY.—Of the modern sciences psychology is undoubtedly the most misunderstood, and principally for two reasons. First of all, probably no science is referred to so frequently by persons who have an entirely inadequate conception of its accepted meaning, its problem and methods. Scarcely a day passes but in some newspaper we read of "an eminent psychologist" testifying in court in connection with a prominent trial for murder. It is usually safe to assume that the witness in such a case is unknown to professional psychologists of the land; that he is probably a physician who knows a little about insanity; and that he has had no training such as modern universities afford in their psychological laboratories. Again we read in the magazines or in novels about the "psychology" of this, that, or the other thing, as if "psychology" were a word to conjure with! I have before me a clipping of this type whose heading in bold face declares "PSYCHOLOGY OF BUTCHERS PART OF WAGE INQUIRY"! In another column of the paper, I am attracted by a "psycho-expander" for the chest! Often, too, speakers will round out their sentences with expressions like "the psychological moment" or "it is a psychological fact", when the significance of these words is misleading or ambiguous. In various ways, then, the real meaning of psychology is obscured. But, to complete the work of concealing the true nature of psychology, a second

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feature is added: psychology is supposed to be a mysterious art which operates best in the dark! It is something mystical, supernatural, and has to do with the world of spirits and with the soul. No ghost in a dark closet ever held firmer sway over the child mind than does this type of "psychology" over public opinion; and no ghost could be more easily dispelled. A visit to a well equipped psychological laboratory in any of our larger universities would do much to convince the skeptic or to disillusion the misinformed. But since to most persons such a tour is impossible or inconvenient, following are, briefly, the essential facts concerning the nature of psychology in its modern aspects and the problems which it attempts to solve.

2. DEFINITION.—*Psychology is the science of mental phenomena.* It begins by emphasizing the scientific nature of the study of mind. This text is being written in a psychological laboratory comprising some twenty or more rooms full of apparatus designed especially for the study of mind. There are scores of such laboratories in this country and in Europe, each one of them stocked with apparatus valued at \$20,000 or more. Some years ago the writer made a study of these laboratories and visited more than twenty in this country, in England, and in Germany. This development, however, is simply an indicator: hundreds of laboratories and thousands of dollars' worth of apparatus do not make a science. Many valuable facts in the sciences were discovered with very little apparatus, or in some instances by means of crudely devised instruments. Psychologists were called into the army with other scientists; they frequently worked without the aid of equipment; but they took with them the indispensable tool of all sciences: the scientific method.

It was this method that was responsible for the widely known tests whose aim it was to make our army mentally as well as physically fit.

But before discussing methods let us return to the definition: the science of mental phenomena. What are mental phenomena? What is mind? It is as difficult to answer these questions without going into circular arguments as it is to define matter. *Mind is that phase of the living organism which is aware or conscious.* It consists of experience and accumulated experiences. Its phenomena are sensations, feelings, imagery, memories, thoughts, emotions, actions, and the like. The inscription on the ancient Greek temple at Delphi, "Know Thyself" was incompletely answered until mind as well as body was examined. Aristotle, one of the most careful thinkers the Greeks produced, saw at once that his description of the world would not be complete unless he included treatises on mind, and he set to work to write what is probably the first text-book on psychology. Time and time again the question concerning the nature of the mind arose in the history of thought and many a philosopher has undertaken to find a suitable answer; hence the frequent confusion of psychology with philosophy and the long and late affiliation of the two subjects. Theologians, too, have tried their hand at the task because the mind seemed at first, and indeed for a long time, something like the soul or spirit. The word "psychology" literally means *the study of the "psyche,"* or soul; hence the connection with spiritualism. Very few text-books, however, today mention the soul: the number is so small as to be practically negligible. The main difficulty with the term "soul" is its unscientific usage and meaning. What we today mean by the

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"soul" cannot be investigated in the laboratory; the discussion of this subject is left to theologians and philosophers.

A useful distinction is commonly made between mind and consciousness. *Mind is considered as the complete organization of experiences in any one individual, living organism; while consciousness is a bit of the organization, a momentary phase of it.* In one connection we say, "that person has a wonderful mind"; in the other, "I have the consciousness of being alone." We are conscious or aware of this or that; our consciousness changes from moment to moment, but our mind goes on until death. Our mind is the stream; our consciousnesses are the eddies in it. Another way of putting it is, mind is the entire system of processes; consciousness is its chief characteristic: to be mindful is to be conscious.

The reader may be aware of the inadequacy of the foregoing definitions; but all definitions of fundamental considerations are inadequate. If these preliminary statements were entirely adequate, there would be as little purpose for the writer to continue writing as it would be for the reader to proceed with his reading of the text. All that can reasonably be promised with continued writing and reading is an increased understanding of the terms used. When the last page is turned, psychology, mind, consciousness, and many other terms will presumably be clearer than they are at this point. One of the best known manufacturers of phonographs and records advertises in a recent catalog, "A . . . record never sounds the same no matter how often you play it. The record doesn't change, but *you* do." So, as the terms occur over and

over again, they will not change as they stand on the printed page, but *you* will.

3. METHODS.—The same difficulty that has presented itself in connection with other terms appears again when we discuss the chief method of psychology: *introspection*. Novelists and others write of it as if it were a sort of morbid, self-centered reflection. A famous physician has this meaning in mind when he writes in diagnosing a case of palpitation of the heart, "It may be due to indigestion, constipation, or introspection." To the psychologist and to those trained under his instruction it means nothing more than a very careful analysis and report of their mental phenomena. This may be easy or difficult, but there is nothing morbid about it, nor is the person who does it self-centered. He is least of all interested in himself: he is objectively concerned with mental happenings, but his own individuality, if he is a true scientist, is never taken personally into account. Introspection becomes easy when the problem is simplified: when I gaze on the red disc of the setting sun and turn to find that the red disc has given place to green after-images wherever I look—that is an easy piece of introspection. It is easy when the observer has been trained to introspect by habit and second nature; just as the botanist so educated easily sees a dozen species of ferns where the common tourist sees but one or two, or none at all. Introspections have been recorded when the observer was undergoing an intense emotion or was being anæsthetized: these were difficult. When a companion of mine accurately reports the variegated coloring of a sky at sunset, he is introspecting; when the patient tells the doctor the medicine tastes bitter, it is as good a bit of introspection as can be found any-

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where. The literal meaning of the word suggests "looking within", because in the historical development of psychology it was supposed that we had an "inner sense" which did the reporting; or that the mind resided within the body. Both of these notions have since been proved not only erroneous but ridiculous. One "inner sense", by an easy logic, leads to an infinite number of "inner senses", as Aristotle early pointed out; but his successors paid little attention to him! Consciousness inherently means this awareness and its consequent report if called for. Likewise, while it is an interesting pastime to study the various places in the body where philosophers from time immemorial have allocated the mind, we now know that you cannot conceivably place something that has no physical dimensions, like the mind, into a physically measurable body. *Introspection* then means nothing more than a *careful examination of mental processes reported preferably in psychological terms*. If the processes were not examined while they were going on, then they may sometimes be scrutinized immediately afterward: this is called *retrospection*. Emotions, instinctive and habituated performances, and dreams are frequently analyzed by retrospection.

Recently psychologists have heard and read much concerning another method. A few of them have even withdrawn into a reform school known as *behaviorism*. The observation of the behavior of animals, including both man and the lower animals, has long been a supplementary method of psychology. With a human observer reporting his introspections it is often considered wise and even necessary to add whatever information the experimenter can gain by way of observing eye-movements, facial expressions, or manner

of speaking, and to interpret these bodily expressions in terms of introspective data either of the subject or of the experimenter himself. The behaviorists, however, are planning to do away with introspection entirely and to study mind from the behavior of the reflexes of the body, from the movements made, or even from chemical analyses of the secretions of glands. One of them is now at work studying young babies from this point of view. What the result will be is hard to predict: we shall probably learn a vast deal more about the reflexes and the emotions. We have already obtained much valuable information concerning sensory discrimination and associative connections.

Introspection, retrospection, and the observation of behavior cannot furnish mental facts and laws to the science of psychology unless they are carefully controlled so that we know practically all the conditions under which the mental processes which we are examining are occurring. We should like to observe these processes repeatedly under the same conditions; we should like to change the conditions under guidance; and in some cases we should like to isolate the conditions. The same rigorous care that the chemist or the physicist takes with material objects must now be exercised by the psychologist in his dealings with mind. For that reason most of our results date from the establishment of the first psychological laboratory in 1879; and nearly all experiments are now performed under strict laboratory conditions. Introspection, retrospection, and the observation of behavior are scientifically valueless unless they are experimentally controlled and the conditions painstakingly recorded.

4. MIND AND BODY.—Much in the past has been

written about the relation of mind and body. Most of this is philosophical discussion, and therefore does not concern us here. We have seen how illogical it is to confuse mind and brain or to station mind anywhere in the body. But whatever our philosophical interpretation of this relationship may be, the fact remains that mental changes are frequently accompanied by bodily effects such as changes in breathing, circulation, digestion, the secretions of various glands, and other organic reflexes. Also bodily changes are accompanied by mental effects. Drugs seriously interfere with a man's way of thinking; and a bad liver may make a man mentally disagreeable. For that reason trained psychologists are usually well instructed in the intricacies of the human body and especially of the nervous system. The physiological and anatomical sciences do not contribute any new facts concerning mind, but they aid in the explanation of facts already discovered in the psychological laboratories. Many theories of mental function have reference to the physiology of the body.

5. SCOPE.—We have indicated that the objects of psychological study are mental phenomena. But mental phenomena may be discovered in many directions. An elementary text-book usually confines itself to the scientific study of mind as found in general in the normal adult human mind. It is the study of the typical mind as we best know it. After we have the standard mind well portrayed, then we can go on with the study of the more unusual, and perhaps for that reason the more interesting, forms of mental phenomena.

The more important branches of psychology follow:
If we investigate the variations of mental process,

capacity, or function from individual to individual, we enter the field of what is known as *differential psychology*, or the *psychology of individual differences*. A study of abnormal minds, both subnormal and supernormal, both defective and unusually efficient, brings us within the realm of what is known as *abnormal psychology*. When minds show diseased conditions, by way of temporary disturbances such as hysteria, or by way of the permanent insanities, *pathological psychology* or *psychopathology* investigates them. *Psychotherapeutics* is the study of mental healing. *Child psychology* gathers facts concerning young human minds, while *genetic psychology* treats the child mind, the primitive mind of the race, or the various minds of animal forms as a growing development. *Comparative psychology* compares mind with mind, whether it be the lower animal mind with the higher form found in man, or the minds of different lower animals with each other, in order to throw light on the complex mind found in man. When the animal mind is studied for its own sake, it is called *animal psychology*. Minds influenced by the conscious presence of other minds are discussed in *social psychology*. The psychology of races and the psychology of peoples are known respectively as *racial psychology* and *ethnic psychology*, or sometimes less exactly as *folk psychology*. *Physiological psychology* undertakes to examine the underlying bases of nervous, muscular, and glandular action in connection with the explanation of mental phenomena.

Then there are problems related to other professions, to the arts, and to the industries. *Educational psychology* is of great assistance in the complicated task of training children in the schools, students in the col-

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leges, employees in industry, even men in the army. Business men are now looking to psychology to help them solve the problems of advertising, of the "labor turnover," the selection of men for positions, and the vocational guidance of men preparing for and seeking a position. Much of the selection of men in the army by means of psychological tests is applicable to business conditions. The anti-social types that bring grief and disaster to society are diagnosed if possible in advance of the commission of crime. The Illinois state law, and the laws of some other states as well, give the trained psychologist a legal position on a par with the medical officer in the court-room. Besides mental examinations this officer makes examinations of witnesses and in other ways brings his psychological knowledge to bear on the case. But psychology has also been applied to the arts and especially to musical performance in order to study the needs of an individual and his peculiar aptitudes for the various musical instruments.

6. SUMMARY.—Psychology is not a magical art, but it is a scientific attempt to study mental phenomena under strict laboratory conditions of introspection, retrospection, and behavior. In place of the "soul" psychologists study the *mind* and its phenomena wherever found. The mind is the complete organization of processes in any individual case: all the thoughts, emotions, ideas, perceptions, and actions from birth to death, while consciousness applies to momentary awarenesses. But this mind, though closely related to the body, is not resident in it. For the study of mind the psychologist goes to many different sources, touches some other subjects very closely, and incidentally is assisting many arts, professions, and even business interests in the problems that confront them.

REVIEW QUESTIONS

1. What two false attitudes have prevented a proper understanding of psychology?
2. Define *psychology*, *mind*, *consciousness*, *introspection*, *behavior*, *social psychology*, *psychopathology*.
3. Distinguish between being interested in mental phenomena and being self-interested.
4. Clearly indicate the difference between *mind* and *brain*, *psychology* and *physiology*, *experiences* and *physical occurrences*.
5. Name five other sciences which have become affiliated with psychology in the search for knowledge.

CHAPTER II

SENSORY EXPERIENCE

7. SENSATION.—Almost all psychologists are agreed that, whatever the other factors in mind may be, even the most complex mental processes which can be found may ultimately be traced to sensory experiences, *i. e.*, the experiences arising from the stimulation of our sense-organs. These are the first experiences to appear in the child and in the race, and they form the foundation of all mental life. But for that very reason they are difficult to recognize. Sensory experiences in their purest, elementary form are rarely if ever found in the complex mental life of the human adult. It has been a long mental history from the animal form, whose consciousness consisted only of sensation, to the human mind of today; and even the child mind from its earliest moments, when it is aware only of sensations, soon develops by leaps and bounds to a much more complex organization. Several examples will suffice to illustrate the pure essence of sensory experience—the *sensation*.

Suppose we are awakened in the morning by a rumbling sound in our ears. We are not fully awake, just awake enough to hear the sound. Before we are able to attach any meaning to the noise, that is before we even barely recognize it as the passage of a heavy truck over the rough pavement, we experience the simple noise quality of the rumble. If the rumble is itself a simple noise, that would be a sensation. A very pure tone, as the tone produced by a carefully made boat whistle, heard under similar conditions, would be a pure sensation. Again, if an experimenter

shows his observer a white piece of paper and the observer is able to strip his awareness of that paper of all of its significance, subtract the meaning of "paper" or surface or material of any kind, even remove the tendency to name the quality "white" or anything else, but experience just the quality of whiteness as a junco-sparrow would see the whiteness of snow, then it is likely that the sensory experience has been reduced to lowest terms.

8. **SENSE-QUALITIES.**—It is furthermore indicative of the progress of psychology since Aristotle that, as mental analyses became more and more refined, the larger grew the number of distinct sense-qualities. In place of the original number of five, almost fifty thousand separate qualities have been enumerated. Some of these are more alike in quality than others, and some, like those of smell and noise, have not yet been satisfactorily analysed and counted. As scientific investigation proceeds, more qualities will probably appear and some others of those already known may develop to be other than qualitative. For purposes of classification it has been convenient to follow very closely the sense-organs involved, but in certain cases there seems to be a psychological similarity in quality even though the sense-organs are much different in structure and location. Some day when facts are more clearly ascertained, we may depart from this traditional classification of sensory groups; for the most part, however, the chief qualitative characteristics are indicated by the group.

9. **AUDITORY SENSATIONS.**—Sensations of sound, or auditory sensations, are usually subdivided into those of tone and those of noise. By far the greater amount of experimental work has been done on tones.

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Tones that are most familiar to us are not pure tones, but contain, as one can easily discover by careful attention, an entire series of tones, which are higher than the principal tone. In bells, however, some of the tones are lower than the principal one to which the bell or chime is tuned. All of these tones, variously called partials, overtones, harmonics, and undertones or ground tones, bear a very simple physical relation to each other. The vibration rates are simple multiples of the fundamental tone. It is predominantly by means of this series of pure tones in the complex that we are enabled to distinguish the quality of one voice from that of another, or to recognize the melody carried by the violin as distinguished from that of the cornet in the phonographic record. But if we are careful to experiment with pure tones we come to the conclusion that the average person can hear about eleven thousand distinct tonal sensations from the very lowest tone of about 16 complete vibrations per second to the highest tone of about 40,000 vibrations per second. Introspectively, of course, the observer knows nothing about the vibration-rates: they are physically determined; but he does notice a change in pitch from the low to the high tones; that is, he has pitch discrimination. This discrimination is naturally much more refined than the series of musical notes which we use in our tempered musical scale. There are only about a hundred of these notes, ranging from about 40 vibrations to 4000 vibrations, but whenever the instrument on which the musician is performing is not already tuned to the notes, as for instance in the case of the violin or the voice, then this pitch-discrimination is utilized in producing the exact tone required. Below and above the region of distinct tonal sensation we

hear nothing but noises. Some writers state that in combination with the 11,000 pitch qualities, there are to be noticed the qualities of diffusion. It is claimed that the low tones in addition to being low in pitch are roomy, diffuse, big; while the high tones are thin, constricted, small. It is significant that almost all of the pitch names assigned to notes in the various languages are suggestive of spatial conditions; and yet many authors point out that tones, though possessing this attribute of diffusion, really lack extension in space. One does not estimate a tone as being so many feet square. Recently, also, we have read considerably concerning the vowel quality of tones, the low tones sounding like "u" in "duke", then like "o" in "show", the next like "a" in "palm", the next like "e" in "fête", and the highest of all like "i" in "machine". But not enough is yet known about these matters to speak with certainty concerning them.

Noises are often classified into two large classes of explosive and continuative noise. A thud, crack, or snap would indicate the former; and the roar, roll, and hiss, the latter. But these differences seem to be largely matters of the duration of the noise and not of inherent quality. There is no doubt, however, concerning the fact that noises possess the quality of pitch as can be easily verified from the use of the xylophone in band music.

10. VISUAL SENSATIONS.—Just as 11,000 auditory sensations of tone and a still unanalysed number of noises have taken the place of a single sensation of hearing, so the one sensation of sight has been differentiated into about 35,000 separate qualities. Visual sensations can be described in terms of one or more of three systems of quality. First of all there is *tint*

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which means the lightness or darkness of the sensation. To the whites, grays, and blacks only this quality can be assigned; they lack the other two. Then there is *hue*, which signifies the quality in terms of such usual color-names as violet, blue, yellow, orange, *etc.* The principal psychological *hues* are a slightly purplish red, green, blue, and yellow. When we speak of blue being dark or light, we mean that the *hue* remains the same, but that the *tint* changes; when we try to match a dark blue to a green of equal darkness, the *tints* are the same but the *hue* is different. Finally we notice qualitative changes in *saturation*; that is, the *hue* may be very rich and pure in quality or it may be dead, dull, washed out in appearance, and ultimately hardly distinguishable from gray, or any degree of *saturation* between these extremes. For example, we might take some bright red water-color of medium tint and gradually mix with it proportionate amounts of white and black. If we keep the amounts of black and white absolutely proportionate and mix them more and more with the red, the red becomes lifeless and subdued; it loses *saturation*. Some qualities that ordinarily pass for different *hues* are really variations in *tint* and *saturation*. Pink is a red, made lighter in tint and somewhat less saturated; buff is a yellowish orange, light in tint and unsaturated; brown is an orange, dark in tint and unsaturated. We can distinguish 150 differences in hue without much change in tint and saturation; and we are capable of discriminating about 700 differences in tint value from the extreme whites through all the grays to the deepest blacks.

When the 150 hues are arranged in order around a psychological color-band, we find no gaps or breaks

in the band to allow for the "ultra" reds and "ultra" violets, because in psychology there are no "ultras": everything not represented by conscious experience is excluded. So we can begin with any hue and go around the color-band back to the place where we started. Let us begin, for example, with blue; we pass on through the violets, purples, reds, oranges, yellows, olives, greens, blue-greens and back to the blues. If we make this a circular band, then by passing over the diameter to the hue at the other end, we find the antagonistic or complementary hue. Thus red and green, blue and yellow, olive and purple, orange and blue-green, are complementary hues.

The laws of color mixture usually state that (1) *the mixture of any two complementary colors in the proper proportion produces gray*; (2) *the mixture of any two uncomplementary colors produces an intermediate hue*; and (3) *a mixture of two mixtures, each of which has resulted in a given gray, will itself produce the same gray*. These laws can easily be demonstrated by rotating color-mixers or even by spinning tops with colors mounted on them. A neat application of the first law of color-mixing is the common practice of dyeing white goods with a light bluish tint before they are put on the market. The blue combines with the light yellow, a color induced by aging of the cloth, and the result is a faint gray which seems to be more pleasing and salable than the light yellow. Bluining used in washing produces the same effect.

There are some very well marked physiological peculiarities which have to be taken into account in the discussion of visual sensations. If the left eye is closed and the right eye fixated on a spot drawn on a piece of paper which also contains two and one-half

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inches to the right of the spot, a well marked cross, the latter will normally become invisible at a distance of from eight to ten inches from the eye. This marks the blindspot of the right eye, the place where the nerve enters the back of the eye on the nasal side and where there are consequently no sensitive end-organs. A similar area can also be found in the left eye. Then, too, the normal eye is capable of seeing all the hues only around the area of central fixation; in the next zone, reds and greens disappear; and finally in the outer zone, no hues are visible at all. In the outer zone a government gold certificate could not be told from a silver certificate; but, curiously enough, movements are most readily detected. There are, of course, many cases of partial color-blindness, especially to the reds and greens. It is estimated that about three per cent or more of the male population and a little less than two per cent of the female population are color-blind. Total color-blindness is much rarer; in which cases gray sensations take the place of all the colors. It is also of interest to note that with oncoming darkness we steadily become blind in the immediate center of vision. As a matter of fact, there are two sets of nerve endings in the retina of the eye: the *rods* for night vision, and the *cones* for daylight vision.

11. TACTUAL SENSATIONS.—In this sense department we have another illustration of the results derived from experimental procedure; it is one of the last to submit to analysis. Although physiologically the function of corresponding sense-organs has not yet been fully established, psychologists have demonstrated beyond doubt that the ancient single sensation of touch has at least four different qualities. These are *cutaneous pressure*, *pain*, *warmth*, and *cold*. One

or more of these qualities may presently be subjected to further analysis; but, as they stand, they are introspectively quite different sensations. The first is similar to the old "touch" sensation; the second used to be confused with the emotionally unpleasant experience of discomfort or "painfulness"; and the last two were considered as variations of a single "temperature" sense. As a matter of fact, not only are these four qualities introspectively different, but even a crude exploration of the skin with a dull lead-pencil will demonstrate the fact that they are not all to be stimulated at the same places on the skin: there are places where pain is felt, but not pressure; warmth, but not cold; and so on. The skin is indeed a patch-work of little spots which are sensitive to some kinds of stimulation and not to others.

12. ORGANIC AND KINÆSTHETIC SENSATIONS.— Closely associated with the last group, and historically an outgrowth of it, is a fourth class of sensations which belong peculiarly to the body; in being conscious of them we usually assign them to disturbances in our own organism and not to objects in the outer environment. Partly for this reason, partly for the reason that they are almost constantly with us as a background to our general consciousness, and partly because of the fact that stimulation of them from without the body takes place through the medium of the skin and results in an accompaniment of tactual sensations with which they are frequently confused, they were for a long time left out of account. Some writers originally called them a "common" sense. The organic sensations are not yet well classified or described because they are difficult to investigate. For the most part they consist of sensations arising in the thorax and abdomen, from

the movements and secretions of the larger vital organs inside of the body. Recent experimentation seems to indicate, however, that there are no new qualities to be found in these regions, that the qualities are very much like some of the tactual qualities or some of the qualities presently to be discussed under the kinæsthetic group, but much less definitely and accurately localized. More research in this group is needed and is probably forthcoming.

The kinæsthetic sensations are better known and classified. They are sensations arising from bodily movements, and consisting of three distinct qualities, with a possible addition of two other qualities which are more or less assumed but not introspectively analysed or confirmed. The sensation of *muscular pressure* is experienced when some heavy object rests on a large bundle of muscular fibres, for example on the biceps or on the muscles of the forearm, thigh, or back—a dull, diffuse, heavy sense-quality, the large component of the fatigue complex. Another kinæsthetic sensation is the thin, strain quality found in the *tendinous sensation*, so-called from the fact that it arises from sense-organs in the tendons and is most frequently felt in those places, like the ankle, wrist, or sides of the forehead, where tendons abound. Then there is the *articular sensation* of friction arising in the joints and commonly felt when the finger is pushed and rotated against its joint at the knuckle. Whenever we move any portion of our body or even when the movement is executed without our control, we experience one or more of these kinæsthetic sensations.

There is a small group of two sense-qualities collectively called the static senses and usually classified

under the same general heading as the kinæsthetic sensations. Of these, the *ampullar sense*, probably never becoming clear enough in consciousness to be introspected but entering into a complex of reflex movements and their conscious effects, is one which is aroused by rotation of the body or by stabilizing the body in any given position. It has lately been extensively investigated and discussed in connection with military aviation. Together with many other items it makes up the complex experience of dizziness. The other static sense, termed the *vestibular sense* is supposed by some psychologists to indicate any change of motion in the body, either from a position of rest to motion, or from motion to rest, or a variation in the amount of motion. This can be sensed without the aid of any other sensation, but it is again a question whether we have here a psychological or a physiological sensation; that is, whether the "sensation" ever takes form in its conscious antecedents.

13. GUSTATORY SENSATIONS.—The variety of taste qualities has suffered a sharp reduction: analysis does not always multiply; in this case it has markedly simplified matters. There are only four tastes: *sweet*, *sour*, *salt*, and *bitter*. The richness of tastes at a banquet table can be explained by a very simple laboratory experiment. If a small sample of carefully filtered coffee is given an observer who is blind-folded and cautioned not to inhale during the trial, and later a small quantity of tea of equal strength is applied to his tongue under the same conditions and with proper precautions as to rinsing his mouth, he will ordinarily be unable to sense the difference. In the same manner honey is confused with molasses, and wine with vinegar. Introspection reveals the secret: other com-

ponents than taste assist us in sensing what we commonly call "tastes". The most important of these aids is smell: we smell and taste at the same time. When we have a cold in the head so that smell does not function in its normal capacity, our food tastes differently. Much of the flavor of food is really odor, as is decidedly the case when even slight decay is detected. But there are other components. Cold mashed potatoes "taste" differently than warm ones; granulated sugar "tastes" differently than does powdered sugar. The fact is that the tongue is capable of sensing tactual qualities in addition to the four tastes proper: *warmth*, *cold*, *pain*, and *pressure*. In addition a number of mixtures of the taste qualities is possible. All these factors taken together account for the great variety of so-called "tastes".

The tongue shows, curiously enough, some of the peculiarities of the eye in the distribution of the sense-qualities. There is an insensitive area in the center; sweet is sensed at the tip; bitter at the back; sour at the sides, and salt generally over the whole surface outside of the insensitive area; but these areas vary somewhat from individual to individual, and with age.

14. OLFACTORY SENSATIONS.—The classification of the qualities of smell sensations is in a very unsatisfactory state at the present time. We do not know how many qualities there are, but we suspect that there are a great many. The sensitive area is well inside the nasal passage and very difficult of direct stimulation. The best that has been done is to group the odors into nine classes, but the names applied to these groups suggest that the qualities are not named on the basis of any introspective description but in terms of characteristics belonging to the objects that arouse the

odors.

This is indeed a long roll-call of sensations, a list that may in the future be reduced, rearranged, or augmented; but the emphatic point to remember is that each and every one of these many thousands of sensations is, by nature, at our present writing, as distinct as the ancient five senses were ever intended to be. These are the *qualities*; now a word about the quantitative aspects of sensations: we have discussed their nature, but not their degree or amount.

15. QUANTITATIVE ASPECT OF SENSATIONS.—First of all, sensations vary in *intensity*. We may have hues and tints that are faint, others that are bright; sounds that are soft, others that are loud; odors and tastes that are weak or strong as the case may be. Every quality named in the classification may undergo changes in intensity from one extreme to the other. If conditions are kept favorable, variations in intensity can be made so small that the increase or decrease is not noticed provided the ratio of change to the original quantity is kept within a certain constant limit, as, for example, $\frac{1}{100}$ for visual sensations, $\frac{1}{6}$ for tonal sensations, $\frac{1}{20}$ for pressure; in taste, smell, warmth, and cold, the constant has not been as definitely determined but is probably somewhat larger than any of the preceding. These facts are gathered together in a mathematical formulation known as Weber's Law. According to this law, it is claimed that, if other complications did not set in, a lobster might be boiled alive without discomfort to himself provided the increase of temperature remained below the constant for warmth! Of equal interest is it to study at what point of physical intensity stimulation comes to the threshold of consciousness: at one moment it is not sensed,

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then with a slight increase it just begins to appear as sensation in consciousness. Another quantitative attribute common to all sensations is *duration*. A sensation may be brief or long or any degree of duration between these extremes. Legato and staccato playing on the piano show chiefly variations in duration of the tones produced. A third quantitative aspect is *extensivity*, or spatial area. Here we find differences of opinion, but some of the most reliable observers report that only some sensations, namely visual, tactual, and probably kinæsthetic, are extended. We cannot conceive, or for that matter perceive, a red quality that has no spatial dimensions, that is, that is theoretically like a mathematical point. But sounds are not of this character, nor are the remaining sensations. Sounds, tastes, and smells do not require description in terms of dimension. A fourth characteristic of the degree of sensation is *clearness*, although again there is not uniform agreement. When we discuss *attention* we shall understand the situation better. Experiences that are clear in mind are usually also strong in intensity, but they need not be. We can attend to the soft feminine voice at our side in spite of the tremendously loud attack on our ears of a passing military band. The faint trace of gray smoke on the horizon can become perfectly clear to our vision in spite of the glare of the sunlit sea. Since we have thus an independent variation in the sensation, a new attribute is necessary; and that we call *clearness*.

16. AFTER-IMAGES.—“Image” leads one to think that we are to describe either something that is akin to the stuff that imagination and memory are made of, or to some visual sketch, or outline, like the reflected image in a pool of water. But the effects described

under this term have primarily to do with sensation, and are furthermore not at all limited to visual sensations but relate to practically every group of sensations. The most pronounced effect is visual: if any quality is experienced for some time, the opposite quality comes to consciousness. Red produces an after-image of green, blue produces yellow, black produces white, and so on. Those effects are really sensory in character and, save for historical usage, should be called after-sensations. The results just cited are instances of negative after-images because the effect is opposite in quality to that of stimulation. In this sense, negative after-images are peculiar to visual sensation. There is a positive after-image in practically every sense department, lasting only a short time after the stimulation ceases and increasing in effect with brief stimulation.

17. ADAPTATION.—The longer a given stimulation is experienced the less intense it becomes and more and more does it change its qualitative nature. All hues tend to become gray; and all tints in time become middle gray. That does not mean that we become accustomed to the red light of the photographic dark-room in the sense that we do not notice it; rather we become physiologically incapable of sensing the red as such. Practically all sensations show this effect, but none more definitely than visual, tactual, olfactory, and gustatory sensations. The cook in the kitchen and the chemist in the laboratory literally become less conscious of the peculiar olfactory qualities easily sensed by the visitor.

18. MIXTURES.—We have already discussed mixtures of physical color-effects in vision. It is quite clear that in this case sensations are not mixed because

no amount of introspective analysis can reveal the qualities contained in a mixture of papers producing gray: they may be composed of colors, dozens of them, or simply of black and white; but the observer cannot tell the components until the rotation is slowed down, or by inference. The mixture of weak sweet and salt solutions also produces an effect of "flatness" that, like visual mixtures, cannot be analyzed. With musical analysis the situation is quite different: an opening chord sounded by an orchestra cannot only be differentiated into separate notes but an expert can tell what instruments are contributing to that total sound. The same statement, of course, is true of an "amen" rendered by a quartet. But tastes also blend to produce new tastes, and these can frequently be analyzed into component parts. Milk chocolate easily reduces to sweet, bitter, a certain "oily" pressure, with sometimes an astringent pressure added. Smells blend to produce new odors or to cancel the qualities altogether, both of which effects, like visual mixtures, cannot be introspectively reduced to the constituent elements: the one is illustrated by combining xylol with turpentine, the other by mixing tolu balsam and iodoform. A good many deodorizers operate according to the latter principle; others combine with the objectionable odor to produce a pleasant one. Heat, burn, cool, and wetness are tactual mixtures. Fatigue and dizziness are complexes of organic and kinæsthetic components.

19. CONTRAST.—In some sense departments the presence of two dissimilar qualities of sensation in consciousness at the same time enhances their respective effects. Strips of blue and yellow, olive and purple, red and green, black and white, show these qualities to advantage because they are placed close together.

Vivid hues have pronounced effects on neighboring hues or tints even when the reciprocal effect is not so noticeable. Certain colors of clothes, furs, hats, and the like enhance or depreciate the effect of complexions. Contrasts are also to be found in taste, smell, and tactual sensations. Sugar, too weak to be tasted, becomes sweet to the tongue when salt is placed on another portion of the tongue. The contrasting effects of cold and warmth were known for many hundreds of years in the old experiment of dipping the two hands respectively in dishes of cold and warm water and then placing them simultaneously in a third basin of tepid water. To the one hand the water will seem warm, to the other cold.

20. SUMMARY.—We have now seen the vast array of facts known concerning the sense qualities; we have furthermore tried to show how a quality can be isolated, but how rare that isolated quality really is in actual unanalyzed experience; we have drawn up a classification of thousands of sensations into six large groups, and have shown the development of these groups from the ancient five sensations; we have also had a word to say about the attributes of quantity: intensity, duration, clearness, and extensity; and finally we have briefly discussed certain phenomena more or less general to all groups of sensations. All of this is a necessary preparation for the subsequent consideration of functions and processes of mental life.

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REVIEW QUESTIONS

1. Reduce to simple sensations the following experiences: (a) walking, (b) talking, (c) reading, (d) dressing, (e) eating.
2. Describe the cover of this book in terms of *hue*, *tint*, and *saturation*.
3. Show the advantages and disadvantages of using red and green light as important railroad signals in place of other colors.
4. Draw up a complete classification of all sensory *qualities*.
5. Describe the "touch" of a fountain pen in terms of the *quality*, *intensity*, *duration*, *extensity*, and *clearness* of sensations aroused.

CHAPTER III

PERCEPTUAL EXPERIENCE

21. MEANING.—When we discuss perceptions we are on a level of mental development which is more complex than that of sensory experience and, therefore, at our stage of development, nearer to everyday experiences. It was difficult to define a pure sensation: most of the details about sensations are learned not, as it were, by photographing immediate experiences, but by analyzing the photograph. We know what we mean by perception directly from ordinary occurrences. We look out of our office window and get visual perceptions of other office windows with names painted on them and behind them other people at work; in the middle of July we have tactual perceptions of perspiration; we experience auditory perceptions of cars, wagons, feet moving along the street; in the spring we have olfactory perceptions of the fragrance of peach blossoms; we can perceive in terms of taste the sourness of milk or the sweetness of the coffee; and we can perceive in organic processes the headache which is discomforting us. In short the living organism, in perceiving, establishes certain relationships between itself and its environment in the sense that it is aware of what is going on about it or even within itself.

The relationships referred to are frequently interpreted by the organism in terms of an inherited tendency or group of tendencies. Much of our aversion to certain sights, odors, and tastes, is due to racial experiences which have left traces in our nervous systems that are part of our heritage at birth. The

perception of blood involves this type of meaning; similar in interpretation but also somewhat more complex is our perception of fright as expressed in another's face. Perceptions take on color, too, from other processes that happen to be in mind at the time. In business all of our perceptions tend to assume a "business" meaning: the persons with whom we are associated in the office look business-like to us; after office hours the same persons may be perceived in quite another setting. Even our tone of speech may naturally have changed. In the same way the perceptions of objects on the stage of a theatre are formed in accordance with the setting. How ridiculous it is for an actor to whisper so loud that the whole audience can hear him, while another actor in the same room with him cannot; or, for that matter, how strange for us to perceive a room with only three sides and those forming obtuse angles with each other! Again perception becomes colored with the associations from previous experiences which attach themselves to the perception of the object in terms of imagery. Out of an unexpected hiding place we take an old photograph of our boyhood home, a letter from a friend, or the button we wore during one of the Liberty Loan campaigns, and at once we are conscious of a flood of revived experiences which give life and significance to the perception. There are three ways, then, in which perception may interpret the relations of our selves to our environment: by inherited tendencies, by associated groups of complex mental processes, and by imagery which attaches immediately to the perception itself. This is the problem of *meaning*; and the last factor—immediate imagery—is the most important.

22. NATURE OF PERCEPTION.—The process of per-

ception may then be described as that operation of mind which brings mind in touch with its immediate environment; mind becomes acquainted with its present surroundings primarily through perceiving objects. Analytically the principal portion of the perception is made up of sensations, sometimes several different kinds of them. We perceive an apple by biting into it, looking at it, hearing the sound of the teeth entering the substance of it, smelling the aroma of it, touching its smooth cool surface with lip, cheek, and hand, and by tasting its sweet-sour flavor. Here we have run the whole gamut of sense departments. Any one, several, or all of these corresponding sensations may enter into the perception of the apple. Some perceptions are, of course, much more restricted. In perceiving a tune, the chief items are auditory sensations, but in a good many individuals the kinæsthetic factors of humming the tune might accompany the sounds and form part of the perception.

In addition to the sensations which form the essential core of the perception there are attached images, which are carried over from previous experiences and are the principal conveyors of meaning. Every new book that we perceive carries in its texture mementoes of books previously seen. These reminders may be very obscure; a few images may stand for a good many meanings telescoped together, but their presence makes all the difference in the world between a perception of a strange voice and the perception of the voice of an old friend.

23. QUALITATIVE PERCEPTIONS.—When perceptions are characterized chiefly by a union of several qualities of sensation they are commonly called qualitative perceptions. The "taste" of coffee, consisting

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of the aroma—the bitter taste proper and the warm tactual sensation—is such a perception. The blending together of tones into a clang or a chord is another example. Sometimes the distinction is made between “complications” in which, as in the first instance, the qualities come from several different sense departments, and “fusions” in which, as in the second instance, blending takes place in the same sense department.

24. SPATIAL PERCEPTIONS.—By far the larger portion of work has been done on the subject of perception of space, both of area, that is of two dimensions, and depth or distance, the third dimension. Spatial perception can occur only in those sense departments which admit of the attribute of extensity: vision, touch, and kinæsthetics. We localize other sensations in space but we do not perceive space directly in terms of them. It is shown by experimentation for example that we localize sounds by noting differences in quality and intensity as these come separately to the two ears and by moving the head about until such differences are well marked. Smells are also given position in space and distance by relative differences in intensity. We have seen that visual and tactual sensations, and probably kinæsthetic sensations as well, are always experienced in terms of spatial size. When we perceive this extent, as when we make an estimate of it, we have a clear spatial perception of two-dimensional space. But we learn most clearly to estimate distance, or, what amounts to the same thing, the third dimension or the thickness of objects facing us and seeming to us therefore as solid. Instead of looking out upon the world and perceiving it flat as in a photograph, it stands out as an aggregate of solid objects. This sort

of spatial perception is called *stereoscopic* and the instrument which enables us to see photographs or drawings in this manner is commonly known as the *stereoscope*. The underlying principle is simple.

The most important factor in stereoscopic perception is the fact that each eye being trained on a given object of perception at an acute angle—an angle which grows more acute as the object comes nearer—receives a somewhat altered picture of that object. Even an amateur photographer knows that the view of a building depends upon the angle from which the picture is taken; moving from one street corner at a crossing to the other materially changes the picture of the building. So it is with our eyes, save that our eyes are nearly always taking different pictures at the same time; that is, we have binocular vision; the exception occurs when the eyes are focused on the horizon or a far distant point. The disparity of the retinal images, as this is called, has occurred so long in the race, in those animals that have binocular or “two-eyed” vision, that the nervous system is already set for the interpretation of these as indicators of depth or distance. The same thing is true of the second factor that helps us to interpret distance: the amount of convergence of the two eyes when focused on an object. Not only are the pictures different but the adjustment of the muscles of the eye-ball to get this result are given to us in terms of amount of kinæsthesia; the greater the pull, the closer the object, as in the case of the near end of an approaching bridge; the more relaxed these muscles are, the farther off are the eyes “sighted”, as in the case of the far end of the bridge from the same position. The doubling of objects on either

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side of the fixation point is another indirect factor which contributes to the establishment of the third dimension. This can be easily demonstrated by holding a pencil in front of a pen and fixating the eyes on the latter; the pencil then appears double. Reverse the process with the objects in the same position but with fixation directed on the pencil; now the pen appears double. The doubling of all objects not directly fixated, while generally unobserved with a high degree of attention, does nevertheless contribute "filler" to our perception of space.

But individuals with only one functional eye, that is one-eyed or monocular people, can still see objects as solid and locate them at varying distances; with practice they do it very well. For the ordinary individual, not so habituated, this is difficult. A ring suspended from a lighting fixture is a very poor target for the insertion of a pencil at arm's length with one eye closed. Of course when the other hand is holding the ring the trick is much easier because we can get relative estimations of distance from the movement of our muscles.

There are a number of items that contribute to the perception of distance or depth in monocular vision. Parallel lines converge in the distance, and the position of objects along these lines can thus be interpreted. Well known figures are absolutely and also relatively larger when near at hand; shadows and the outlines of the figures are better defined and more distinct. Shadows themselves, as every artist well knows, lend depth to objects; near objects, furthermore, partially hide objects farther off; and then there is the purely physiological factor which may give an unconscious setting, namely the automatic adjustment of the lens of the eye to the distance, known as accommodation.

Before we leave spatial perception, tactual space perceptions must also be mentioned. For many decades it has been maintained that all tactual sensations come to consciousness with a "local sign" designating qualitatively the part of the body stimulated: we would have for example not merely "warm sensation" but "warm sensation from the sole of the foot". Introspection, however, fails to reveal such an additional quality: we localize usually by some other group of sensations; or the local setting is given unconsciously. But we can very well distinguish spatial forms that are applied to the skin, in which sense we have a tactual spatial perception. In the same way we experience spatial relations through kinæsthetic sensations when, for example, we trace an outline in the air of a canoe or of the figure "4". From earliest years through reaching for and walking toward objects we learn to estimate distance by movement.

25. TEMPORAL PERCEPTIONS.—Just as the extensive attribute furnished the basis for spatial perceptions, so does the durational attribute of mental processes make possible our awareness of the lapse of time. When measured against actual physical duration we find results similar to those of spatial perception: relatively small areas and small units of time, when filled, are overestimated. A line drawn between two points on the page seems longer than the original space between the points; so estimates of times lasting physically less than .75 seconds, when filled with rapidly occurring clicks, seem longer than the actual duration. Contrasted with this, on the other hand, a distance on the floor occupied by a line of people or the size of a hall filled with spectators, is underestimated; and, as we know altogether too well, a long interval

of time seems short when we are in pleasant conversation with agreeable company, and seems long when we wait alone. In all cases the difference seems to depend somehow on the number of physical objects or events that occur, but more introspective analyses of the actual mental processes are needed.

It is assumed, however, that the estimation of time, and therefore the perception of time, depends upon the process of mental organization—the method followed in the temporal perception. The smallest units of time, *i. e.*, under .75 second in duration, are perceived probably in the form of a rhythmical organization of the series of events; those ranging from .75 second to 4 seconds are apparently estimated in terms of the quantitative characteristics of the mental processes themselves and of associated processes; and units of time beyond this limit seem to be estimated only in terms of immediate memory or by retrospection.

The problem of estimating the duration of time during sleep has also engaged the attention of psychologists. It is commonly supposed that there is a sort of temporal perception which lies in the background of consciousness and which is based upon certain rhythmical physiological activities which occur in the vital organs of the body.

Allied forms of temporal perception are rhythm and melody. Rhythm consists of certain quantitative and, in some instances, qualitative changes of sensations that are systematically repeated until they become mentally organized into groups. Melody develops pitch changes until the entire series becomes a mental group. Rhythm may depend upon changes in duration of the members and of the intervals between the members, also upon changes of intensity, and, in the case of

tones, sometimes upon pitch. These changes may not occur physically at all, as in the swinging of a well balanced pendulum or metronome, but they will be mentally attributed to the sensations that result. Rhythm may take place in terms of auditory, tactual, or visual perceptions and is usually accompanied by marked kinæsthetic sensations, such as keeping time with the foot, hand, or finger. Visual rhythms have occurred with the use of colored lights, or with lights differing in duration, brightness, or spatial arrangement.

26. PERCEPTIONS OF MOVEMENT.—We perceive movement when an object crosses our field of vision, or even when we fixate the object and then move the head or body. Movement is frequently inferred when we see only successive positions of a moving object. Under some conditions our perception of movement is just as vivid when we are moving and the object is stationary, as in the case of objects seen from a moving train. Occasionally, however, we assume the movement of our selves when the object seen is in fact moving, as in the case of a train moving out of the station on an adjoining track or in the experience at amusement resorts of a trip to the moon in a grass cage equipped with moving curtains depicting the imaginary sights on the way thither. But when we are led to perceive movement under circumstances that physically reveal no movement at the point of fixation, as at a performance in the moving picture theater, then we have a peculiar type of perception of movement known as *stroboscopic perception*, and the laboratory apparatus which produces this effect is known as a *stroboscope*. The pictures are thrown on the screen in a long series of instantaneous exposures, for moving the film

across the light from the lantern while we were looking at the screen would, of course, result in blurring the entire picture. Indeed we would see no picture at all. The same phenomenon may be noticed in those advertising signs that give the effect of movement by mechanisms which turn on series of lights showing successive positions of movement. The underlying explanation of these results is based on the presence of positive after-images which last through the interval when the light is periodically shut off. The same effect occurs, incidentally, in the field of tactual sensations when a number of points are successively touched on the skin—resulting in the perception of a moving object crawling over the skin.

There is also a curious after-image of movement that occurs after long gazing at a waterfall or any object continually moving in a given direction; in the case of a waterfall, the landscape on each side of the fall appears to go up.

27. ILLUSIONS.—Perceptions sometimes do not serve the organism very well; we are fooled into assumptions that are not correct. The subject is so large and has so many applications to problems of everyday life, even to the camouflage of war, that much restraint is required in order to treat it in a few paragraphs.

There are three sense departments—visual, tactual, and kinæsthetic—especially the first two, in which illusions are very frequently encountered. In the visual department are the well-known geometrical or optical illusions (a) of reversible perspective, indicated by the outline figure of a cube or a pair of crossed lines seen either projected forward or backward; (b) of variable or constant extent, as shown in alterations of equal distances by adding lines or by filling

in; (c) of variable or constant direction, illustrated in the alteration of the direction of parallel lines by using cross lines; (d) of associative areas and extents, as in the case of equal angles enclosed, in the one instance within a large angle and, in the other, within a smaller one; and (e) of combinations of various effects previously enumerated. There are also visual illusions due to physical distortion through lenses, mirrors, and the atmosphere, *e. g.*, the mirage; and in like manner there are physiological illusions due to effects produced within our sense organs: contrast and after-images. The visual illusions of movement, as the apparent movement of the moon among the clouds, and the illusions of distance, as the nearness of a fire or the mountains in clear air, complete the list in this sense department.

The tactual illusions include those (a) of juxtaposition, referred to long ago by Aristotle in his example of the apparent doubling of a pea held between crossed fingers, and illustrated by the reverse effect when the lobe of the ear is bent forward and dull compass points stimulate it and the side of the head in back of the ear at the same time, producing only a single sensation; (b) of parallel lines distorted when drawn across various parts of the skin as, for example across the mouth from ear to ear; (c) of movement, as when objects seem to crawl across the skin; and (d) of the temperature effects noted by contrast from previous stimulation.

The kinæsthetic illusions are chiefly misrepresentations of weight due to suggestion derived from visual estimation of size, as in the well-known size-weight illusion. A small container equal in weight to a large one will be overestimated in weight because of the unexpected effort required to lift it. There are many

other less well established illusions such as the lifting of objects from various heights.

28. SUMMARY.—We have seen that a perception involves the direct awareness of objects in our mental environment and that it is a relatively complex process made up principally of sensations with a background of images referring to past experiences and giving meaning to the perception. Meaning may also be had in terms of the association of other processes in the same consciousness and occasionally in terms of physiological tendencies some of which may be inherited from the past experience of the race. Then the qualitative, spatial, temporal perceptions, and perceptions of movement were described in detail. Qualitative perceptions, like tonal fusions, depend principally upon the combination of different kinds or qualities of sensations; spatial perceptions depend upon the attribute of the extent of visual, tactual, and kinæsthetic sensations, giving rise to the awareness not only of area but also of depth and distance, due essentially, in vision, to the disparity of the retinal images and convergence of the eyes in stereoscopic perception and a number of factors in monocular vision; and temporal perceptions depend upon the attribute of the duration of all kinds of sensation. Rhythm and melody combine several attributes but are frequently classed as temporal perceptions. Illusions are illustrations of incorrect reports of the environment where the error lies principally in some factor of the physical situation or in the physiological disposition of the sense organ.

REVIEW QUESTIONS

1. Name three ways in which perceptions may make our environment significant.
2. From your immediate surroundings illustrate *qualitative*, *spatial*, and *temporal* perceptions.
3. What is the relation between *stroboscopic* perception and the perception of *movement*; between *stereoscopic* and *spatial* perception?
4. Outline according to sense department three classes of illusion.
5. Give one example of each of the five classes of optical illusion.

CHAPTER IV.

IMAGINAL EXPERIENCE

29. **THE IMAGE.**—It was difficult to describe the most fundamental of the elementary mental processes, the pure sensation, because it seldom occurs in our present complex mental life as an isolated unit apart from the other processes that are closely organized with it in the perception. In the simple image we have an additional difficulty in that, as we have before noted, the term suggests a visual diagram or outline. The fact is that we may have simple images similar to every known kind of sensation.

30. **THE SIMPLE IMAGE.**—What is the simple image? Consider the melody of any national song. Most of us can hear the opening strain of "The Star Spangled Banner" as if some band were playing it or as if people were singing it; that is, we can hear it mentally in the absence of any immediate stimulation. The mental processes which are carrying that tune are known as images; but they are not at all simple: that melody is full of meaning, is frequently accompanied by bodily reactions in the form of organic sensations and feelings; it arouses a host of associated processes. Take the first note, however, strip it of any meaning whatsoever, do not mentally ascribe to it a word or a musical name, but get the tone as purely as if blown lightly on the mouth of a bottle or as if produced by a lightly struck tuning-fork of that pitch, and you will probably have a simple image. In other words *a simple image is any qualitatively simple mental process which refers to an object recognized as not being immediately present to the senses.* This reference fre-

quently occurs just after the experience of the simple quality, as when a peculiar sound is heard which later turns out to be the work of the imagination. Simple images belong to the second class of elementary mental experiences and are sometimes therefore called "imaginal elements". A few writers have termed them "centrally aroused sensations" because they are very much like sensations in character but are aroused physiologically at the central part of the nervous system, that is, in the brain, while sensations correspond to excitations at the terminal sense-organs. There is some question as to whether, stripped of all reference or meaning which the simple quality of an image or sensation soon acquires, there can actually be found any pronounced difference between the qualitative characteristics of an image and its corresponding sensation. Usually the image lacks the definiteness and insistence of the sensation; it is more vague, changeable, and is frequently weaker in intensity. Under ordinary circumstances an imaged tone is not as loud or as clear as one that is sensed. Under other conditions we are uncertain, especially at low intensities, whether the experience which we are having is being imaged or sensed; consequently, as we shall later see, hallucinations result. Where the stimulation takes place in our own bodies, as in the organic, kinæsthetic, and some of the tactual groups, we are even more confused on this point. It is often difficult to tell an imaged muscular pressure from an actual sensation of muscular movement: an incipient muscular twitch resulting in a muscular sensation may be interpreted to mean an imaged experience, as the behaviorists would have us believe; or reversely, as physicians well know, many painful experiences, taken to be actually sensed, are only very vividly imaged.

31. **THE QUALITIES OF IMAGES.**—Substantially, images follow the same qualitative classification which was outlined under sensory experiences. We have auditory imagery when we hear melodies “running through our heads”; we notice visual imagery when we “see things with the mind’s eye”; tactual images come with a “creepy feeling” or with the imaged softness of plush; with the former, however, may frequently be found also deeper lying organic and kinæsthetic imagery turning then into actual sensation, as when reading a ghastly story the “creepy feeling” gives rise to “goose-flesh” and the contraction of groups of muscles. Gustatory imagery can easily be recognized in the experience of opening a box of chocolates and anticipating the bitter-sweet taste; and smell imagery is common to the memory of the meadows after a brief, refreshing rain or of “the pungent scent at evening in the cool hollows of burning brush heaps . . . and above all, the deep, earthy, moist odour of new ploughed fields.” It is not altogether an easy matter to describe one’s mental imagery with scientific fidelity because one type of imagery may be called in as a substitute for another. A psychologist who is also a good musician told me that he never had an auditory image in his life: all the melodies which he tried to recall came as muscular imagery of throat-adjustments, as in humming. So from an evening’s dance we may carry away not the music of the orchestra in auditory imagery, nor the glitter of the costumes in visual imagery, but the fragrance of a corsage bouquet which attracted our attention—and which therefore will for a long time be associated with the dance. For accurate information on such matters it is consequently best to trust the introspections of a trained

observer. The actual wealth of imaged qualities, moreover, while theoretically equal to the wealth of sensations, falls far short of it. It is possible to get 700 tint values in sensory experience but imagery furnishes us with a much more limited number.

32. **THE QUANTITY OF IMAGES.**—In matters of degree we find the same parallelism with sensory experiences as there is in quality; and with the same limitations. With respect to intensity, duration, clearness, and extensity, images follow the course described under sensations, save that they are almost invariably diminished in quantity: less definite, weaker, and less durable. They lack the commanding power of sensations. Exceptional instances occur, however, but these will always refer to the types that are really border-line cases. Instances of visually imaged colors have been reported with subsequent negative after-images.

33. **THE IDEA.**—More familiar to our everyday experience is the idea of the complex mental process built up on the basis of simple images. As we have seen, the image is not a very stable or definite process: it ranges from the sensory character of the after-image, through the experience found in *synaesthesia*, which applies to the peculiar sensing of tones as colors or as tastes and of other similar combinations, through the more removed *memory after-images* to be later discussed, through the so-called "*hypnagogic*" images, which, woven out of the tracings of previously seen objects and of other visual effects, pass in review just before falling asleep, through the images which are mistaken for realities of the outside world and are therefore termed *hallucinations*—through all the foregoing images to the characteristic image which forms

the foundation of the ideas of memory, imagination, expectation, and thought. It is the latter type which we are now prepared to scrutinize.

Shut off from external surroundings, secluded from the multitude of challenges and assaults which the world makes upon us, we are still subject, sometimes distressingly, sometimes comfortably, to mental processes intimately connected with our past, present, or future experiences. Genetically they are born of past experience but they may hark back to all time and place. They are presumably peculiar to the higher animals, especially man; and they have contributed more to civilization than any other form of mental process. We know them scientifically as ideas; and the mental function involving the use of ideas is termed *ideation*. Just as the perception cannot be without its core of sensations, so the idea must have its principal group of images. In addition, however, it is essential that the idea should refer to some object not at that moment present to the senses.

34. INDIVIDUAL DIFFERENCES IN IDEATION.—It is a well-established fact that everyone is given to different methods of thinking, remembering, or planning. Even in such matters as piano-playing without score individuals vary widely. One sees the music printed out on the page of a familiar or preferred edition; another plays from the tune as it runs "in the head"; still another gets no notion of the tune until his hands begin "tickling the keys"; again, a person may carry some melodies one way, some other melodies in another, and so on. These differences are well marked off into four types of ideation: the first type is the visual; the second type is the auditory; the third type the motor or kinæsthetic; and the last a versatile or

mixed type. This classification does not mean, of course, that visualizers, for example, never have any other sort of images; it indicates, however, that most of their ideas take the visual form by preference and habit. But it does mean that there are fairly definite ways in which we are set to do most of our mental work. The next time that you try to remember a catch-phrase which you have just heard, see how you go about it. Do you naturally write it down somewhere and then recall it as it appears on the paper; or does the sound of the words repeat itself almost incessantly in your mind; or do you find yourself attempting to make the necessary movements in your throat to say it; or do you do a little of each, or perchance sometimes one, sometimes another? Since words imply both motor adjustment and the sound of the uttered expression, some authors name the second type as auditory-kinæsthetic or verbal.

It is worthy of note at this point that persons totally blind from birth or even perhaps from the sixth or seventh year of age are incapable of having visual imagery, and for like reasons totally deaf persons have no auditory images or ideas—showing that, as regards ideational type, our mental life is dependent upon previous experience. The claim is also made and fairly well established that children have more pronounced visual imagery than have adults: adult ideation tends to become verbal, due to the increasing use of language in our mental lives. Where planning requires diagrams, sketches, and outlines, visualizers have a tremendous advantage, whereas public speakers are much aided by auditory or kinæsthetic imagery.

35. HALLUCINATIONS.—When we mistake our ideas for perceptions we are said to suffer from hallu-

cinations. No one escapes this tendency, but if it becomes persistent something is wrong. It occurs normally in reverie, but it may also be a sign of overwork, old age, the use of certain drugs, especially opiates; or, in extreme cases, it may signify serious mental derangement. The inadequate function of the idea may be a matter of mistaken intensity, as a distant whisper may become unbearably loud; it may be a matter of form, as tombstones turning ghosts at night; or it may be a matter of qualitative interpretation, as a piece of gossip is changed to fit your frame of mind. In the extreme case there may be no sensory background at all; the hallucination is then fashioned out of whole cloth or a figment of the mind.

36. SUMMARY.—We have described in outline the character of the simple image which belongs to the second class of elementary mental processes and forms the principal constituent of the idea. Although the simple image may have the same qualitative and quantitative attributes as the sensation, in typical instances it is vaguer, less intense, and less stable than the sensation; and while its variation from the sensation is gradual, it does exhibit the peculiar characteristics of a reference to objects that are mental, *i. e.*, not immediately present to the senses. On this account many persons erroneously consider the subject of images and ideas the proper approach to the field of psychology. The idea, which is the complex process founded on imagery, is also subject to qualitative variation, but in the main individuals fall into four large groups with respect to the habitual use of visual, auditory, motor, or mixed imagery or ideas. Just as illusions were described as the incorrect functioning of perception, hallucinations were found to be the inadequate functioning of ideas.

REVIEW QUESTIONS

1. What, in the psychological sense of the term, is a *simple image*?
2. In what kind of imagery do you tend to remember the date and time of an appointment?
3. From conversation with your acquaintances find examples of the four types of ideation.
4. Which is more advantageous: auditory imagery to the musician, or visual imagery to the landscape painter?
5. In what mental complexes are images essential?

CHAPTER V

AFFECTIVE EXPERIENCE

37. **FEELING.**—With feeling we come to an altogether different aspect of mental life and one which also is beset with difficulties arising from the technical use of popular terms. The word “feeling” is used with meanings ranging from the simplest awareness to the most complex judgment. Strictly it is used in psychology, however, in connection with the emotional or affective phase of mind. Besides the apprehension of our physical environment in terms of perception and the representation of it in terms of idea, mind is affected by feelings. In other words there are degrees of response to immediate or to more remote environment in the form of affective or emotional coloring. We are not only capable of perceiving tones but we can also be pleasantly or unpleasantly impressed by them; we are not only able to recall the social affair of last evening or to project tomorrow’s concert into our future experiences, but it is also more than likely that these processes come with some degree of warmth. Whether it be the warmth of pleasantness and comfort or of dislike and disagreeableness depends upon circumstances and the individual, but few experiences leave us cold and indifferent. Psychology designates this phenomenon, then, by the term “feeling” or “affection”. When reduced to lowest terms of analysis, it is a simple feeling or affective element.

38. **AFFECTION.**—Most psychologists agree that all of our affective experiences are resolvable into one or two qualitatively different simple feelings or *affections*: *pleasantness and unpleasantness*. The very least that

can be said of a mood or emotion or disposition is that it is pleasant or unpleasant. Some writers substitute agreeableness and disagreeableness, like and dislike, and one in particular specifies two additional pairs of qualities, but the first pair—pleasantness and unpleasantness—are the ones most commonly adopted. In this particular field, however, there is perhaps less certainty than in any other so far discussed, since we are confronted with the spectacle of one authority asserting that the qualities of affection are innumerable while another says that there are no affections at all—that the alleged “feelings” are nothing but very weak sensations! For a long time, indeed, there was much confusion between the sensation of pain and the feeling of unpleasantness. Perhaps the next decade will bring us nearer to uniformity of opinion.

The chief difficulties seem to lie in two main directions. Besides the extreme limitation in the number of qualities we find that the simple feeling can never be observed as an isolated process: it does not lend itself to introspective analysis. It is always intimately related to some other process or group of processes. Instead of pursuing its own course with distinctive qualitative changes it suffuses itself over consciousness like a cloud of dust, a glow of warmth, or a chilly wind. In its most complex form it seizes upon the entire psychophysical organism, affecting both mind and body. As one writer has remarked, we are never glad, independently of anything else, but we are always glad about something. In their lowest forms, simple feelings are usually allied to sensations or images. Pleasantness or unpleasantness attach themselves to tones, colors, tastes, and the like. Nevertheless, we cannot therefore assign them as attributes to

these processes because the respective attributes are independently variable. A simple feeling of pleasantness may have an intensity and duration different in degree and in course from those attributed to the sensation of color itself.

The other handicap to psychological investigation is the fact that feelings lack the attribute of clearness. Attention cannot be directed on this process without its immediate disappearance from consciousness; hence the impossibility of introspective report.

39. METHODS OF INVESTIGATION.—Recourse must consequently be had to two special methods of observation, both of which are indirect in their application. One of these, the *method of impression* or of *paired comparisons*, demands an introspective report concerning the perception or idea, with only an indirect reference to the attached affection; the other, the *method of expression*, depends upon the behavior of the systems or circulation, respiration, and muscular and glandular activity in the body under the reflex influence of the prevailing feeling. In the first method a series of tones, colors, odors, or tastes is presented to the observer in pairs and in a prearranged manner, and he is required to report upon the affective response evoked. The clearest process, then, is the perception; the report only incidentally involves the simple feeling. In the other method, specialized instruments are applied to record, usually through a pneumatic system, the bodily effects of pleasant and unpleasant perceptions and ideas; like the *pneumograph*, which records changes in rate and volume of breathing, the *plethysmograph*, which transcribes changes in rate and volume of superficial circulation, the *sphygmograph*, which transmits the rate of the

pulse, the *ergograph*, which measures the strength of voluntary muscles, and the *automatograph*, cousin to the ouija board, which registers the involuntary movements of the arm.

40. SENSE-FEELINGS.—From the simple feelings easily attached to other processes it is an easy step to those feelings that are characteristically bound up with a group of sensations so that they recur from time to time in practically the same pattern. These are the complex processes known as *sense-feelings*. Headache, hunger, thirst, dizziness, nausea, drowsiness, lassitude, and suffocation, are examples of groups of definite sensations accompanied by pronounced feelings that are arranged in a fairly stable organization of mental processes.

41. EMOTIONS.—But still more complex and much more widely recognized are the affective processes listed under the head of *emotions*. Emotions are definite as to course, content, history, and function. The course in consciousness is precipitous at the beginning with many associated and incorporated processes; it flares up the moment the adequate perception or idea touches it off; and it is slow to die down, coming only gradually to a conclusion. Reference to the typical emotions of fear and anger, love and hate, will readily confirm this statement. In content we have usually an inciting perception or idea which is at once organized into a mass of other ideas and perceptions together with a characteristic complex of organic and kinæsthetic sensations, leading frequently to some expressed or inhibited movement together with effects on the vital physiological functions of respiration, circulation, digestion, innervation, and on the secretions of various, especially the ductless, glands. The entire com-

plex is strongly suffused with pleasant or unpleasant affection. The history of emotions, biologists tell us, leads us back to the time when emotions, intimately related to and not infrequently accompanied by instinctive reactions, were of prime importance in helping the animal survive an emergency of defensive or offensive attack or other equally essential crises. Emotions have lost much of this primitive function, but they probably still answer the purpose of introducing a wholesale change in the ideational sequence and organization of mind: producing a sort of temporary mental revolution to clear the atmosphere and tedium of mental life. But, of course, this is sheer theory.

Neither a numerical count nor a qualitative classification of emotions is available: on these points great divergence of opinion still prevails. One classification, for example, is based upon a genetic difference: the primary emotions, like fear and anger that do not depend on the individual's previous experience, as compared with the derived emotions, like remorse and pity that depend more on social traditions. Another classification emphasizes temporal reference, as the immediately insistent emotions of joy and sorrow and the remotely insistent emotions of hope and fear.

42. SENTIMENT.—When an emotion is governed not principally by the inherited tendencies deeply ingrained in the texture of mind, but chiefly by considerations developing out of social tradition and educational influences, it gives place to a *sentiment*. Sentiments are farther removed from the instinctive bases of emotional expression and are more allied with the thought processes. Patriotism, friendliness, gratitude, honor, esteem, and condemnation are sentiments.

43. MOOD.—Sometimes emotions die an extremely slow death or never fully embark on their career: they stay at low ebb for a long time. They are then more properly termed *moods*. A mood, then, is an affective process, usually more or less complex, that is relatively weak in intensity and long in duration. While an emotion may expel mental processes not akin to it, a mood absorbs and colors them in the course of their appearance.

44. DISPOSITION AND TEMPERAMENT.—When an affective response becomes not only long in duration but an integral part of a person's mental texture or a habituated form of action, we speak of a *disposition* or *temperament*. If an individual has a temporary lapse and falls into a pessimistic strain, we say that he is in a pessimistic mood; but if he is known to be in that condition day after day and from his earliest days, we say that he is of pessimistic disposition or temperament.

45. PASSION.—An intense affective complex, usually of short duration, coming precipitately to a focus and retreating in the same fashion, is a *passion*. It gains in intensity what it lacks in duration, nor has it the typical organization of an emotion. It is not as definitely integrated. All voluntary control is inhibited.

46. INTEREST.—Objects are of interest to us when we attend to them with some affective response. It is a combination of a high degree of clearness and feeling, usually pleasant in quality.

47. SUMMARY.—The third class of simple mental processes includes affections or simple feelings, limited to the qualities of pleasantness and unpleasantness and

lacking the possibility of becoming clear processes in consciousness. They are not themselves items in consciousness but are readily attached to other processes. Consequently two indirect methods are in use in the investigation of feeling: the introspective method of impression or paired comparisons, and the behavioristic method of expression. Emotions are very complex feelings but with an orderly and inherited procedure. They are intimately related to instinctive forms of reaction, but have not yet been adequately classified. Sense-feelings, sentiments, moods, dispositions and temperaments, passions and interest are other forms of affective response.

REVIEW QUESTIONS

1. Explain why introspection is replaced in the field of affection by two indirect methods.
2. Describe, possibly from your own experience, *affection, sense-feeling, emotion, mood, sentiment, temperament, and passion*.
3. Make a list of your emotions in the course of a day and trace the instinctive reactions in each case.
4. Contrast an emotion started by an idea with one initiated by a perception.
5. How is interest related to feeling and to action?

CHAPTER VI

MENTAL ARRANGEMENT: ATTENTION

48. ORGANIZATION OF MIND.—So far we have been chiefly concerned with the problem of analyzing mind into its principal and rudimentary parts: all mental experiences, however complex, may be introspectively reduced to groups of sensations, simple images, and simple feelings. And on the basis of this analysis we are justified in ascribing certain functions to the various operations of mental processes: services which they render to each other, to the mental life as a whole, and ultimately to the psychophysical organism. They augment one another, give continuity to mind, and bring the organism in touch with its environment. But there still remains the problem of arrangement of processes in point of time, both simultaneously and successively. Mind is not only organized in regard to function—what each process does or means—but also in regard to prominence or obscurity of its processes. To every mental process that is complex, and to all simple ones except affections, there attaches the attribute of clearness, which we have already discussed. In other words, mind stands organized from moment to moment with certain processes in the foreground and others in the background, but with a constant shifting of relative attentive clearness. Instead of proceeding on a dead level, certain processes momentarily become more significant, receive favored positions, as it were, retain them for varying amounts of time, and then again recede into the background. Here we are confronted with the problem of attention. Hysteria, hypnosis, sleep-walking, and certain mental derangements are intimately involved in the discussion

of attention, but we must leave them to more detailed treatment in books especially devoted to these subjects.

The normal human mind, therefore, is an orderly procession with certain processes standing out above the others, only to give way later on to still another group. In this way our minds are capable of responding adequately to an environment that presents many more claimants for our notice than we can expeditiously handle. We have come to see, then, that attention is nothing more than that state or condition of the mind in which mental processes are found in varying degrees of clearness. The normal mind is always in a state of attention. Inattention simply means not that the mind is failing to attend but that it is attending to matters which for some reason are judged by others to be unworthy of clearest attention at that moment. Some abnormal minds are popularly considered inattentive if attention is not directed long enough to the matter in hand, just as other abnormal minds are inclined to hold a few objects in a high degree of attention too long. "Attention" in such circumstances has come to mean a high degree of attention.

While it is admitted that there may be some individual exceptions, it is generally held that the most frequent type of mind shows only two levels of clearness, a level of processes of maximal clearness, or foreground, and a level of obscure or unclear processes in the background. In this type the degree of clearness between the two levels is marked. Several published experiments seem to indicate, however, that a multi-level type does occasionally occur in which there are as many as seven degrees of clearness.

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49. SUBCONSCIOUSNESS.—Reference is often made to a somewhat mysterious subconsciousness, alluded to also as "*the subconscious*". The assumption made is that there is a second organization apart from the general waking consciousness in which memories lie dormant or buried, associations and even thoughts take place, and in which personalities and selves are duplicated and sometimes multiplied. If it is treated as a mind somewhat out of reach of the normal consciousness, then it would be absurd to fathom it with introspective methods; and if it alternates with the normal mind in consciousness, then it is doubtful whether the term "subconsciousness" is entirely appropriate. In most cases the expression covers ignorance, or at most an hypothesis. Psychologically, phenomena thus discussed fall more properly under the heading of attention and association; for we know that while we are occupied with processes in the foreground of consciousness we are nevertheless aware in an obscure way of sounds, sights, organic disturbances and even of ideational processes. We say that we do not notice the outlines of the sidewalk as we stroll, the buzzing of flies and fans while we write letters, or the ticking of clocks as we converse; but should a blanket of snow obscure the first, should a change of room obliterate the second, should the stopping of the clock put an end to ticking, we soon become conscious of the difference: these phenomena are not present in another mind or consciousness, but in the background of the same consciousness. In some instances, as when we recall names after an unsuccessful attempt, we seem not to be aware of the corresponding processes and it is as good a guess as another to say that they develop physiologically, that is, outside of conscious exper-

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ience. There is no need, however, for postulating an inaccessible mind at this level and calling it "the unconscious", as is done in some texts concerned with abnormal psychology.

50. THE RANGE OF ATTENTION.—One of the important problems in the psychology of attention involves the number of processes that can be held momentarily in the clear focus of consciousness. One hears about individuals who are capable of doing many things at once, like dancing, reciting a poem, and writing separate articles with each hand. History has it that Caesar was able to dictate as many as seven letters at the same time. In such instances it is not established that all of these processes are strictly simultaneous: it is very likely that they rapidly oscillate in clearness at successive moments.

Many types of apparatus, generally called *tachistoscopes*, have been devised to meet the technical requirements of this problem. It is necessary to test the number of items that can be held in clearest attention at a single moment. The period examined must therefore be very short to prevent roving of attention, but it must be long enough to make the objects visually clear. The average time of exposure is about one-twentieth of a second. The instruments used have a variety of forms in an attempt to overcome certain much discussed deficiencies, but the essential provisions are (1) a fixation-point to prepare the observer for the field of exposure, (2) the rapid, smooth, and noiseless presentation of the items to be attended to for an adjustable and measurable unit of time, and (3) the quick withdrawal of the items at the end of this period. The observer

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then records the number of items seen. These may be single letters, numbers, or arbitrary forms. Researches in this field indicate that the foreground of consciousness is restricted to a total of six or seven processes or groups of processes. Six or seven letters or such combinations of letters as combine to produce new units, or even six or seven combinations of words into sentences or stanzas of poetry, may occupy the focus of attention at any one time. The essential element is the unitary mental process, however numerous the physical compounds may be. This maximal range of attention obtains, of course, only under standard and favorable conditions. In hypnosis and hysteria, although greatly magnified in clearness, the foreground is much more restricted in range. Conditions of fatigue and age also modify it.

51. STAGES OF ATTENTION.—So far we have been discussing attention as a general state of consciousness in which processes are arranged in a pattern of clearness and obscurity. We have still to sketch the development in the course of time of any particular group of processes from a state of relative obscurity to that of high attentive clearness. Figuratively speaking, mental processes are continually changing, sometimes exchanging, places in the scheme of clearness values. The different ways in which processes are brought to the foreground and in which they retain their place in the foreground is usually discussed under the heading of the developmental stages of attention.

The first stage or *primary* attention, is probably primitive and largely instinctive. An object (1) that gives intense stimulation to one or more of the senses, like a bright light or a loud sound, or (2) one that appears suddenly, or (3) an object that is moving, or

(4) something that has a peculiar quality, like odd reds and yellows, certain kinds of sound, odor or touch, or (5) an object that is novel, unexpected, and unfamiliar, or (6) curiously enough, things which fit into the present trend of our associations and are therefore congruous with the experiences of the moment,—all of these objects easily compel attention. The sharp rap of the conductor's baton in an orchestral rehearsal, the peculiar sound of the aeroplane overhead, the strong flash of an automobile headlight, the movement of underbrush in an otherwise quiet forest, are instances of the arousal of primary attention. There are naturally many applications of one or more of these principles in advertising, of which the reader will be readily reminded.

The second stage requires effort on the part of the individual because it presents a conflict between two or more sets of claimants for his attention. It is often referred to as the *secondary* stage and is found in the higher forms of animal life. Suppose that two different persons present food to a dog from different angles at the same time. One or the other, perhaps one after the other, will receive attention, but for a few moments there may be a conflict between the two situations. Or assume that it is a warm day and you have an important report to make, accounts to straighten out, or letters to write. Someone suggests an outing or a game of golf or the postman brings the latest number of a popular magazine. A struggle may ensue in which one or the other possibility is strongly presented. Under such circumstances, while the alternative still presented itself attention to the processes involved in making out the report, arranging the accounts, or writing the letter would be of the secondary type.

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If, however, the matter rested and you have become absorbed in the task which was at first irksome so that it is difficult to call you away from it, your attention has then lapsed into what may be called the *tertiary* stage. After the conflict and the effort, the object engrosses the attention without conflict or effort. Authors give different names to these stages where uniformity of designation is to be hoped for, but they are generally agreed in the number of stages and more or less agreed in their description. Concerning the rise and fall of attention, experiments indicate that it takes a process or group of processes from one to two seconds to attain maximal clearness; hence whenever the highest degree of attention is desired, preparatory signals are given, as in the starting of races, in the giving of orders, in the initiation of an experimental series, or in "bringing an audience to attention." Furthermore a single unmodified process cannot remain maximally clear for more than a few seconds. Records on this point are not yet uniformly accurate, but it is very likely that the accounts of processes held for longer periods fail to report minor changes in the processes.

52. THE FUNCTION OF ATTENTION.—We have already stated that attention serves to bring mental order out of physical chaos. It selects experiences in order and organizes them. The highly trained specialist by repeated selection has attached attentive values to his various experiences, which tend to organize the experiences of like nature that are later to recur. Ear-training in music and eye-training in the sciences are not so much a matter of ear and eye as they are a matter of attention, association, and meaning. With practice an educated person has learned to analyze exper-

iences and to set them into proper places. These places are furnished by association, a topic treated in the next chapter. Attention, then, functions as an analyzing operation, but it serves also to synthesize experience by proper organization. We first pick experience apart and then set it together again. The latter procedure is completed by associative organization under attentive scrutiny.

53. SUMMARY.—This chapter has briefly described attention as the organizing function of the mind and as its condition of clearness and obscurity. Processes not only pass in review but they proceed with varying degrees of distinctness. Fundamentally obscure processes are sometimes said to belong to the “subconscious”, but that was shown to be an unnecessary hypothesis. There may be several degrees of clearness at any one moment, but many individuals conform to the type of mind that reveals only a foreground and a background. Many processes like outside noises or pressures from our clothing may remain in the background but they are seldom unconscious. Instruments have been devised for the study of various problems of attention, but especially to investigate the number of single items, or unitary groups of impression, that can be held maximally clear at any one moment. Six or seven such processes have been counted under experimental conditions and average situations. Three developmental stages are described as primary, secondary, and tertiary. It is also found that a process cannot become maximally clear in less than from one to two seconds, and may not remain so for more than a few seconds. In general, attention serves to organize experience through analysis and synthesis of presented impressions.

REVIEW QUESTIONS

1. Compare mind to a pile of mail on the desk: how might *attention* then be illustrated?
2. For what two reasons is it unnecessary to assume a *subconsciousness*?
3. Can a mind ever be a blank? Can it be inattentive?
4. Illustrate what is meant by a *stage* of attention; by the *range* of attention?
5. Indicate five principles employed in advertising to gain attention. Are any of these also used in public speaking; in salesmanship?

CHAPTER VII

MENTAL ARRANGEMENT: ASSOCIATION

54. ASSOCIATIVE CONNECTIONS.—Perhaps no topic in psychology has occupied the attention of the classical psychologists more than the subject of association. Some recognized it as of the same importance as gravitation in the physical sciences; one called it a “gentle force”; several built up a “chemistry of the mind” on the basis of it; and almost all of them have tried their hand at formulating laws concerning it. Few writers in the historical development of psychology have regarded association from the mental aspect, and consequently the laws of association have undergone much modification in recent decades.

With some rather remarkable exceptions, early authorities confined association to the realm of ideas. In present practice, however, there is a strong tendency to regard any complex process as an instance of association: perceptions as well as ideas are associated complexes. Truth is that every new experience that enters consciousness becomes immediately assimilated into the system of processes already in mind, forming associative bonds in turn with still other processes to come. From this point of view, then, mind becomes a tremendous network of associative connections. Yet it is not simply a tangle of unrelated processes, but, in the normal mind, an orderly array; orderly to such an extent that, if all the conditions were known, it would be theoretically possible to predict the associative connections in any particular instance. To the psychologist it is not surprising, for example, that two intimate friends under

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the same conditions should think of the same things at the same time.

It is this organization of consciousness from moment to moment, the development of complex processes, that is discussed under the heading of association. Some items of experience are grouped together when presented for the first time as the fusion of tones in the clang, or the blending of tastes and smells, or any other qualitative perception, and some temporarily successive impressions like members of a rhythm or melody are forthwith synthetized into groups. These are not clear cases of association. But when the taste-blend suggests or means "coffee", or when the melody calls up the accompanying words, we have a clear case of an associated process. In this instance the set of impressions that enter consciousness find waiting for them the representatives of some previous experience which at once attach themselves to the new process or group of processes. This matter was alluded to in the discussion of perceptions and meaning: perceptions acquire imagery, images become associated with other images, ideas with other ideas, and thoughts with other thoughts. The tendencies for some of these associations seem in many cases to be present at birth, ready to manifest themselves at the proper period of development, like the complexes of emotions, instinctive reactions, and accompanying ideas; others are acquired by training and education.

55. THE LAW OF ASSOCIATION.—The attempts to formulate general statements concerning association clearly reveal the errors into which previous thinkers fell. These statements refer to the objective conditions under which associations may take place; they assume that only ideas are associated; they imply that

these ideas are identical with the objective conditions; and they presume that ideas are stable and unchangeable entities like stones in a wall or tiles in a floor. There are four classical laws that appear in the literature: we tend to associate things (1) that are similar, (2) that are in contrast to each other, (3) that occur at the same time, and (4) that occur at the same place. Most of the examples were couched in terms of the recall of familiar objects, although some writers cited instances from other mental processes besides memory. Some of these laws were gradually modified and reduced until with the modern point of view came a wholesale revision and transformation into a single law: *if a mental process that has previously occurred in consciousness is reinstated, other processes that occurred with it on the former occasion tend also to reappear*. There are further statements concerning the conditions of association, referred to sometimes as "secondary laws," but they are more appropriately discussed in the next section.

56. MEMORY.—While, according to our previous description, the topic of association embraces all mental processes of a complex nature in which simpler processes are incorporated, it is more frequently the practice to consider in this connection the higher complexes of ideas that function as memories, imaginations, anticipations, and thoughts, and the relation of the various complexes, like ideas, perception, emotions, actions, sentiments, and thoughts, to one another. Let us first consider memory.

In the memorial consciousness there are always at least two factors to be considered: (1) consciousness consists almost entirely of ideational material and a feeling of familiarity, and (2) there is a distinct ref-

erence to the individual's past. The ideas that occur tend consciously to link the past with the present. This is especially true of all memory images. The *memory after-image*, like the sensory positive after-image, is a brief recurrence of the original effect shortly after its cessation, but not as much dependent on the characteristics of the original impression as is the sensory after-image. It lacks, however, the feeling of familiarity and the backward reference of the true memory image.

Much of the work on memory is concerned with an analysis of the conditions underlying effective learning, retention, and reproduction; that is, (1) the factors which favor the period of impression, (2) those that make for adequate retention during the interval between learning and recall, and (3) those that influence the recall itself. But experimental work has been concerned for the most part with the first of the three sets of problems. In each case the factors might be assembled under the three heads of (a) physical conditions surrounding the individual who is learning, (b) physiological conditions of the organism, and (c) the psychological conditions in the mind of the learner. Under the first rubric we can include the four conditions mentioned in the earlier laws together with such items as: visual *vs.* auditory method of presentation, imposition of a rhythmical emphasis on the members of a series to be learned, grouping of the members, learning by parts or by wholes, position of members in the series, length of the series, distributions of the learning period, recency and frequency of connection, the rate of presentation, length of interval between learning and recall, amount and nature of distracting stimuli, and the methods of eliciting the re-

sponse. Under the second rubric come such considerations as the degree of vigor or fatigue, the age of the individual, the period of the day during which the work is done, and the presence or absence of other physiological disturbances. The last or psychological conditions involve the degree of attention on the part of the individual, the amount of accompanying interest or feeling, the intention to remember, the amount of actual mental preparation in the field of the subject to be memorized and recalled, and the habitual attitude toward one's memorial abilities.

The results that have been obtained in connection with these questions and many others since the classical experiments of Ebbinghaus in 1885, are indeed too numerous and detailed to be given here. Among them may be mentioned, however, the effects that they have had on our educational practices in the school-room and on some of the devices that are advertised in our popular literature. While there are everywhere qualifications to be made, it is certain that, for instance, advantages lie in the following suggestions: it is best to have the material presented both visually and auditorily, with some recurrent accent or rhythm; while the material to be memorized ought to be learned as a whole, it is best to divide the task if the entire amount is too great to be kept as a whole; distribution of the repetitions of a series to be learned has a decided advantage over the method of learning the series with the same number of repetitions during a single period, because as James stated in the example of learning to skate in summer and to swim in winter, progress seems to be made physiologically during intervals that are not occupied with active learning (Jost's law); slight distraction under certain condi-

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tions seems to favor learning mainly because of the increase in the active and attentive effort to learn; accompanying emotion or feeling seems to increase the memorial effect, just as healthy, vigorous, and rested bodily conditions improve both the learning and the recall; and there are many recent experiments that prove the decidedly positive effect of mental attitude both by way of confidence in the ability to remember, and the self-instructed intention to recall what has just been experienced.

Much of this discussion is graphically represented in the "learning curve" which shows by the direction of a line the progress of learning. The vertical units are usually expressed as amount of work accomplished and the horizontal units are marked off as time intervals at which this amount is ascertained and recorded. The line generally shows a marked rise or increase in the amount of work during the earlier periods and a gradual flattening as time proceeds, indicating only relatively small increments of work. There has been discussion of the occasional "dead level" or "plateau" when no gain is made but which is sometimes followed by large increments in succeeding periods.

57. IMPROVEMENT OF MEMORY.—Until recently, authorities were divided regarding the possibility of improving memory in any specific case. Now it seems certain that there are physiological limits set in each individual, within which limits there is hope of improvement, but beyond which lies little or none. These limits may be fairly wide in some cases and narrower in others. Those who have early realized their ability to remember have made further gains through practice and a store of self-confidence.

Development usually follows along the lines indicated in the above paragraph and with the development of interest in certain fields or subjects, *i. e.*, with the increase in the number of possible associative connections to be made. Sometimes it is restricted to certain kinds of material like names, faces, musical selections, phrases, or gestures. Most important is the degree of interest and attention given to the task and the specific instruction which accompanies the material, such as, "I must remember that story," or "That's a good quotation to fix in my memory." Certain it is now that quick remembering does not necessarily lead to quick forgetting. The memory methods on the market capitalize the above instructions and gain their results in the interest aroused, in the time, energy, and money spent, and in the mnemonic devices invented to fix and organize the isolated material presented.

58. IMAGINATION.—The scientific use of the term "imagination" is restricted to a limited range of functions, but there is no agreement as to its exact implications. We speak quite accurately of imagination when we mean the use of imagery without the backward reference of memory or the forward reference of anticipation. We imagine a scene in a book of travels that we are reading when we neither remember having been there nor anticipate going there. And yet, genetically considered, the imagery used in this connection comes from various items of our past experience and may at times be accompanied by a desire to see the place. But there is no necessary conscious reference to one's past or future in an imagination as such. The designation, "reproductive imagination," suggests history rather than conscious relationship of the present process. In productive, creative, con-

structive imagination we have terms that imply the usefulness of imagination as an aid for planning, inventing, and thinking. Just as out of our past mental life we construct in reproductive imagination the scenes laid in the drama we are reading, so in writing a book of our own we may construct and invent scenes by creative imagination from the same source. In this second manner imagination is closely related to the thought processes.

59. **ANTICIPATION.**—Forecasting the probable events of tomorrow's trip to another city, we are again employing imagery which arises out of our past but is not consciously recognized as such: its immediate reference is to the future. In a sense, too, it is creative. Briefly, then, the function of imagery, when directed to the individual's past, is memorial; when directed to the present, it is imaginal; and when directed to the future, it is anticipatory.

60. **RECOGNITION.**—When a perception is accompanied by a feeling of familiarity we term the complex a recognition. It has a varying history. Recognition may take place immediately and completely. At once a sufficient number of details come to mind that place the person who confronts you. However, you may not be so successful; a half-recognition may take place immediately, but all you can say is that the face is familiar. Recognition then is incomplete. An incomplete recognition may be replaced by a complete recognition, though delayed, when some additional item like the sound of the voice clears up the whole situation. When recognition has taken place repeatedly it emerges as nothing more than an ordinary perception. The silverware on our dining table, after years of familiarity, is simply perceived—until per-

haps some burglar makes off with it. Then, if luck returns, the loot is discovered, and we are asked to identify it, familiarity again returns and recognition replaces the former unfamiliar perception.

61. TYPES OF ASSOCIATION.—We have outlined some of the more significant forms of association, but we have not forgotten that the topic properly includes all types of combined processes. Most important of these are perceptions and ideas; together they illustrate the type of association known as *assimilative*. When I look out upon my garden and point out features of it to my neighbor, we both think we are seeing the same things. Our eyes are seeing alike, but our minds are perceiving differently. The tree I am indicating with my finger is perceived by me as the tree that once grew in the woods near a summer resort; he may perceive it as a Norway maple listed in some nursery catalog. Our previous experiences have influenced our present perceptions; and so all of our perceptions are every moment entering minds differently furnished: they become assimilated to the processes already there and are colored by them. A senatorial investigating committee can never see the miner's life as the miner sees it; a friend sees in a political candidate's remark an expression of the highest altruism while his opponent cannot see anything but egotism in it; and a typographical error is repeatedly passed over while a word correctly spelled appears wrong. The same of course is true of our ideas. One person simply cannot conceive of internationalism as anything but a powerful alliance of aggression; another conceives it as the most peaceful affiliation of peoples that the world has seen. Ideas of home, war, right, duty, and love differ in like manner from in-

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dividual to individual. But throughout, the type of association indicated shows a tendency to incorporate the representative elements of a previous experience with the processes at present in the focus of consciousness.

But this type may lead to still another, though related one. Suggest to a group the word holiday and immediately a host of ideas will flood the consciousnesses of the auditors: "no work," "picnic," "fishing," "reading," "loafing," "dance," and many others may crowd consciousness in a flash. This is called simultaneous association, and seems to be by far the most frequent. One idea will set off a multitude of other ideas as a bomb ignites many shells at once in a powder dump.

The other type of association was the one most often discussed by the older writers but is now thought to be of less frequent occurrence. It is the successive type. One group of ideas leads off into another group which in turn suggests a third, and so on. Each group, however, has elements in common with the next. A letter from a friend suggests a social event on a previous visit; that suggests another person whom you met on the occasion, which brings vividly to mind the fascinating conversation, then the chief topic of the conversation, relatives in France; then comes to mind the fact that your brother ought to be on the way back, which suggests the party you had thought of having in his honor, which in turn arouses the idea of writing to a certain friend about the affair, which then makes you think that you had better wait until you hear from her again, and so on. Reveries are occasions for tracing out so-called "trains of thought" which are nothing more than a series of associated ideas of this successive type.

62. METHODS OF INVESTIGATION.—The market furnishes a great variety of apparatus which is used experimentally for investigating associations. Most of the instruments are designed for the purpose of carefully presenting members of a series to be learned under controlled conditions. The methods of investigation fall in two large classes: (1) those examining new associations and (2) those examining old associations. The first group of methods analyze associations while they are in process of formation; the second inquire into associative connections that have already been formed. Because it is necessary to begin with material that has as far as possible no associative meaning and the further desirable feature of being made up of members that are of uniformly equal weight in the series, so-called "nonsense syllables" have been devised. They consist usually of two consonants separated by a vowel and are monosyllabic: NUS, LOD, ZIR, FAW, SOQ, are examples. The second group of methods is divided into the *continued* type in which a word is given by the experimenter and the observer is told to give as many as a hundred words in reply; and the *paired* type, or the method of "paired associates," in which a single response is paired off with each stimulus-word. Both of these types, and especially the latter, may be used as a "controlled association" with an instruction to restrict the response to those words that are related to the given or stimulus-word as coordinate, subordinate, or superordinate, as similar or opposite, as rhymed, as genus to species or the reverse, and so on; or both types may given as a "free" association method without such restriction.

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63. **THE DIAGNOSTIC ASSOCIATION.**—Use has been made of the association methods in order to diagnose a concealed situation. It was hoped at the outset to apply the method to criminals appearing before the courts, and some trials of it have thus been made, but the results probably came from the effects of a refined “third degree” in which the accused finally confessed rather than permit the psychologist to receive the credit. In the laboratory it has usually had good success even with sophisticated observers. In this form the following arrangements are generally made: each one of a series of observers is given the choice of doing one of two or more tasks, like the opening of one of several boxes, the following of one of several instructions, the entering of one of several rooms. In the meantime the experimenter has drawn up a list of single words some of which refer to the one set of conditions, some to the alternative, and some to commonplace situations; these sets of words are given in haphazard order with instructions to reply with the first word that comes to mind after each word in turn is called out; the word and the speed of reply as given by a stop-watch are recorded; and the experimenter, judging from the character of the response-word, the delays in significant responses or in insignificant ones that immediately follow, but without first-hand knowledge, determines what task the observer had elected to do. The observers are frequently not told to conceal the information, but naturally assume that they are to do so.

64. **SUMMARY.**—We have seen how the problem of association attacks the very fibre of mental life, solving the question of the arrangement from moment to moment. The traditional laws are therefore super-

ceded by a more general law. One of the associated groups, memory, revealed a host of problems and results, and improvement of memory lay chiefly along the line of these results rather than in any inherent change of the function. As memory implies the backward reference of imagery, so imagination implies reference to the present, and anticipation to the future. Recognition is much like memory save that its essential mental process is a perception rather than an idea. Three types of association were discussed and illustrated and the methods of investigation classified under two heads with several subheadings. Finally we reviewed, under the name of the diagnostic association, the application of one of the methods toward the analysis of concealed situations.

REVIEW QUESTIONS

1. Show how "Niagara Falls" may at times be a *memory*, an *imagination*, an *anticipation*, or a *recognition*.
2. Mention four physical factors which influence learning and apply them to any specific content to be remembered.
3. Of what force in this connection is the "instruction" to recall?
4. To what extent may memory be improved?
5. On what assumption does the method of diagnostic association proceed? To what uses in business could it be put?

CHAPTER VIII

ACTION

65. THE EXECUTIVE FUNCTION.—Consciousness organized to do, to act, to accomplish, is described as the *actional consciousness*. With this name we designate consciousness as executive in function: mind is not only cognizant of its environment through perception and idea, but it is equipped to alter and affect the environment and the relations of the organism to that environment. The actional consciousness must be distinguished, nevertheless, from motor adjustments of the organism. There are, in the first place, types of movement like reflexes that may not involve consciousness at all. In some of the lower forms these may function, as in the case of the "wiping" movement of the frog, even when the brain is removed. At any rate, in human beings, conscious processes are not necessary components of reflex adjustments: the opening and closing of the pupil, respiratory, circulatory, and digestive mechanisms work very well without conscious attention. In the second place we may experience a typical action consciousness when a movement is not made but is inhibited. When at a flower show we are at times strongly tempted to touch an exquisite specimen and all but do it, consciousness is typically actional, and yet no external movement results. For this reason some psychologists are differentiating *action* from *movement* by restricting the former to those adjustments that involve conscious processes.

This entire field is naturally good camping ground for the behaviorists who look to the manifestations of

movement as indices of mental life. Where outward signs of behavior fail to appear they hope to obtain clues from changes in the body, the secretions of glands, or any other physico-chemical phenomena. Their program lies almost entirely in the future, but in some directions, as in the methods and devices for recording minute muscular and glandular changes, they have made notable progress. It remains to be seen, nevertheless, whether their results will accrue to the benefit of the psychological sciences or more directly to the advantage of the biological disciplines.

66. TYPES OF MOVEMENT.—It is a moot question whether our complex actions have been built up out of the unconscious reflexes or whether the latter are vestiges of the former. A corollary of the latter position ascribes intelligence to the lowest animal forms because the earlier simple actions would then be considered voluntary. The view that actions may develop in both directions, toward higher complication and also toward greater simplification, is now gaining wider acceptance. An act, then, involving a simple conscious motive may proceed toward increasing habituation or toward more involved voluntary action. The series is a gradual one but probably reversible in its genetic history.

First of all, in the lowest form of animal life, there are the tropisms or tendencies to turn toward or away from light, heat, the earth, or various gradients of chemical stimuli.

Then there are the spontaneous movements that are due to an overflow of energy. The most elementary organized movement is occasioned by the *simple reflex*, a response, like the eye-wink, reduced to a simple muscular contraction due to the passage of energy

from a definite stimulus over the shortest route of established nervous connection. More developed is the *conditioned reflex* in which the original stimulus has by training been replaced by another that has accompanied the first. The oft-mentioned dog, whose saliva flows at first with the sight of food, but which later develops the saliva-reflex in connection with the sound of a bell that repeatedly accompanies the original stimulus, is an example. The *vital, organic, or automatic reflexes* are processes which involve sometimes more than one stimulus and always a complex set of reactions, like the respiratory, circulatory, and digestive functions. The *secondary reflexes* are those highly automatized reactions that have been acquired during life but have become "second nature," like the balancing movements of a rope-walker, also the movements involved in combing one's hair, tying shoelaces, and similar performances. They are the automatized habits, sometimes also called sensorimotor or ideomotor actions. The *instinctive reactions* require a much more attentive conscious accompaniment and in many of them there is even evidence of emotional concomitants, but the greater part of the organization of movement is due to nervous connections already made or in process of formation at birth. Examples of instinctive actions are nest-building, hunting, collecting, mating, and movements that accompany many emotions. Instinctive performances are usually quite complex as regards the muscular coordination involved but the entire mechanism is started by a very specific set of stimuli. The *simple impulsive action* is a movement made with a conscious end in view and set off by a simple situation. The motive, whether due to "self-instruction" or to a suggestion or command from

someone else, is realized and foreseen, but the starting point does not present any immediate difficulty or ambiguity. Beginning a race at the crack of a pistol, coming to a halt at command, giving someone a "lift" with a trunk, are some of many examples. From this point on, actions become more and more complex as regards the initiation, the motive, and the resultant course of action. There may be a choice of starting signals, the voice of one whom you know as over against a score of other voices issuing commands; the motives may be conflicting: "to be, or not to be: that is the question"; and the resultant movements may be a complex series extending over some time, as in preparations for a journey.

Some authors make a distinction between voluntary action, which implies a conscious motivation, and involuntary action, in which the movement is either automatized or physiological in its course. Some recent studies have indicated that some of the vital reflexes which are usually beyond the direct control of voluntary effort, like the heart-beat, can nevertheless be consciously influenced. The author has also seen individuals who could expand and contract the pupils of their eyes.

67. HABIT FORMATION AND THE LEARNING CURVE.—While we have already discussed the chief characteristics of the learning curve as developed in connection with association, there is also a legitimate place for its consideration at this point. Statements concerning its form and its interpretation made in the earlier section apply equally here. Typical curves have been drawn up in depicting the acquisition of various skilled movements, such as learning to type-write, to telegraph, to toss several balls at once in the

air, and to wend one's way through a maze with a pencil. Similar curves depict learning in the lower forms of animal life. Thus we may trace the development of habituated action, always remembering, however, that a habit is an automatized performance—which means that, while attention is directed on the movements involved in the earlier stages, the completely formed habit is relatively unclear in the background of consciousness, and requires little attention. The motive, of course, has also lapsed.

68. THE "PERSONAL EQUATION" AND THE REACTION TIME.—The historic rise and fall of the "*personal equation*" and the subsequent development of the reaction-time is a long story to tell. Suffice it to say that the question was first raised in astronomy toward the end of the 18th century when an assistant was dismissed at the Greenwich observatory, in England, for incompetency because he had habitually recorded the transit of certain stars a fraction of a second later than the continental observers had recorded them. The manner of recording was, of course, quite crude but involved a simple impulsive movement by what was known as the "eye and ear" method of stopping a clock as soon as the star was seen to cross a hair-line of the telescope. The dismissal gradually led to an inquiry into personal differences and to the measurement of the *personal equation*. The physiologists became interested because of the possibility of determining the speed of nerve conduction but they were soon quite discouraged when they frequently discovered that stimulation at one point of the body gave a longer reaction than at other points. Finally it was turned over to the psychologists because of the realization that some unknown mental factors had to be taken into account.

So the *personal equation*, or the time that expressed individual variations in executing a movement after a signal is given, was ushered into the psychological laboratories and it emerged as the "reaction-time." During the last quarter of the last century scores of experiments have attempted to analyze and to factor the reaction in all manner of ways. But it was not until Ach, in 1905, systematically presented an analysis of the actional consciousness that the work of these earlier years on reaction-times of choice, discrimination and association were clearly interpreted.

By dividing the entire duration of the action into three periods,—the fore-, mid-, and after-periods,—a careful introspective analysis was made possible. The fore-period reveals the presence of the "instruction" and lasts from the time the "instruction" to act is given until the signal appears; the mid-period, the interval that is measured by precise instruments in thousandths of a second, covers the time from the appearance of the signal until the movement is made; and the after-period lasts for a time after the movement is completed. The outcome of these experiments shows that no one is able to execute a movement at the moment he hears a command or sees a signal: it always takes an appreciable fraction of a second to pull the trigger, to start on a race, or to clap one's hands after the perception of the sign to begin; but it also clearly demonstrates the fact that the differences in the reaction-times of various individuals are due solely to differences in the "instruction" that is given to, or habitually assumed by, the person who is reacting. If the "instruction" is of the "hair-trigger" type, to react as quickly as possible with the attention directed primarily to the muscles involved

in the movement, then the time will be comparatively short and the reaction will conform to the *muscular* type. If the "instruction" emphasizes the quality of the perception which starts the reaction, then the time will be longer and the reaction will be described as *sensory*. In sensory reactions the observer pays attention to the kind of signal which precipitates the action and can be put on guard by introducing at times stimuli of different quality from the one agreed upon. The results are also slightly influenced by the sense departments appealed to by the signal. All time values are conventionally expressed in one-thousandths of a second, represented by the Greek letter sigma. The figures show that average muscular reactions to light are 180 sigma; to sound, 120 sigma; to electrical cutaneous stimulation, 105 sigma; sensory reactions give for light, 290 sigma; for sounds, 225 sigma; and for electrical stimuli, 210 sigma. Fatigue and practice, of course, will alter these figures somewhat. There is also a *mixed* type of reaction in which the agent fluctuates between the other two types in the direction of his attention, resulting in a reaction-time that is an average of the two extremes.

69. THE ACTIONAL CONSCIOUSNESS.—Analysis of action has revealed always a definite organization of processes that lead to the executive function. It is usually more complex at the end than at its inception, but throughout its course it seems to be guided by the motive. In actions that have degenerated into movements like the secondary reflexes, the motive has been replaced by a purely physiological organization. But in typical actions, the results of the action and the underlying motive are consciously foreseen. At the

outset a perception or an idea appears to which the individual reacts by an expressed series of movements or by inhibited movements. Stepping forward to help a person who has slipped on the sidewalk is started by a perception; sitting down to write a letter may be started by an idea. In both instances there are naturally accompanying ideas and in many cases feelings or even emotions of vividly colored consciousness, as is the case in "excited" or "interested" actions. The "instruction" may be carried by a mass of organic sensations or by a verbal phrase like, "I must do that now."

70. THE WILL.—Like the term "soul" the word "will" has assumed something of an unscientific character. Moral obligations and responsibilities are suggested with even religious implications. *Volition* is a more acceptable term. The "will" or *volitional* consciousness differs from the *voluntary* consciousness in that the command is not tacitly followed by the action but is consciously accepted and referred to the *self* of the reactor. An act that is "willed" always reflects the individuality of the person. For a moment the person becomes self-conscious. In this manner he gives the act approval. The volitional act is frequently the outcome of a decision that has been verbally developed and is therefore complex. Often, too, it is accompanied by thought processes or at least by groups of ideas. This is particularly true of a deliberated act to which a final decision is attached.

71. SUMMARY.—Action manifests the executive function of consciousness and is developed in various directions. It is to be distinguished from movement which does not imply conscious intervention. From the lowest tropism, through the various forms of re-

flex movement, to instinct, to simple impulsive action, and to volitional action, is a gradual series with an increasing attentive consciousness and awareness of purpose and result manifesting themselves. Much of scientific treatment of these phenomena has come indirectly from the astronomical and physiological "personal equation" whose discussion finally led to a study of the reaction-time in the early days of the psychological laboratory. Then the beginning of the twentieth century afforded an analysis of the actional consciousness and the importance of the "instruction". Latterly also much work has been done in depicting the development of skilled or habituated practices on the part of the lower animals as well as of man.

REVIEW QUESTIONS

1. Trace six different kinds of movement in the course of a morning's work.
2. What does the learning curve indicate?
3. What criticisms can you pass on such expressions as the "power", the "faculty", or the "force" of the will?
4. In what sense does mind exercise a "function"?
5. Give a brief historical interpretation of the "personal equation".

CHAPTER IX

THOUGHT

72. **THE DELIBERATIVE FUNCTION.**—We cannot leave the subject of human psychology without a discussion of the highest mental function that the human species presents. As far as the evidence goes it does not at present seem possible that any of the lower animals can think in the accepted meaning of the term. But man can clearly apprehend his environment in terms of perceptions and the ideas which represent these perceptions; he can exert his influence in adjusting himself to the world thus apprehended by making suitable movements—and frequently unsuitable ones—but he may also solve, in advance of their application, the problems that the world presents. In other words, he sometimes provides against future contingencies that may arise.

We have already referred to thought in the discussion of creative imagination. But thought processes differ in several respects from the ideas of creative imagination. In creative imagination we begin with a general situation whose requirements are to be met, represented at the outset by a group of abstract ideas; we end usually with a product that is concrete, a melody which we have composed, a plot that we have outlined, a device that we have invented. In thought we start with a very definite situation which is nevertheless perplexing and from it we abstract a conclusion expressed in general terms. Another difference lies in the fact that thought depends upon the meanings symbolically represented in ideas, especially in verbal ideas. Many of the ideas may function vicariously

as related processes. It is of frequent occurrence that a nod of the head, a wink of the eye, or a set of the mouth will not only convey a vast fund of information to the observer, but the consciousness of these movements may be packed with meaning to the individual who is exhibiting them. So also may the visual image of a hazy, dark-brown spot mean "sickness-doctor-medicine"; the picture of a view down a long straight passage may mean "infinity"; and death may be represented by a curved rod slightly draped at one end. It is almost always possible to trace the history of these symbols because they prove to be reduced relics of more detailed pictures. The dark-brown spot may be the imaginal remnant of some experience with a dark medicine; perhaps the paralled lines of the long corridor were sometime suggested by the statement concerning the meeting of such lines at infinity; and the curved rod doubtless is all that is left of the idea of death, the reaper with sickle in hand. There is much of this sort of thing in the thought consciousness, and frequently the ideas and images used in the development of the thought process are even more scrappy and far-fetched. The important fact is that thought utilizes such abstracted materials as the vehicles of meaning.

73. THE THOUGHT CONSCIOUSNESS.—Aside from a small school of psychologists who believe that thought is as elementary an experience as sensation and those who write of "imageless" thought, most writers consider thought to be the most complex mental process of all. It was the last to resist analysis. It is composed of images, usually in their complex form as verbal ideas, but also of visual, auditory, and kinæsthetic types, all of them quite ab-

breviated. They are organized in their course by an "instruction" to solve a problem, and they proceed under a high degree of secondary attention. It is supposed by some authorities that a problem of this type may "incubate" for a time in the nervous system and be resolved on a future occasion. Some experimenters have also found evidence of a new process, called a *conscious attitude* or a *mental attitude*, in which a more protracted meaning is found to be telescoped and condensed. The observers reported attitudes of helplessness, complexity, doubt, effort, conviction, hesitation, and the like. For the time being these seemed to be incapable of analysis, but there is some indication that introspective scrutiny had not been carried far enough. The same criticism is applied against the assumption that thought belongs to a fourth class of elementary mental processes.

74. LANGUAGE.—This is not the place to treat the subject of language as such. We are chiefly interested in it as an expression and vehicle of thought. It must be remarked, however, that it is again an illustration of the symbolic use of sound and form. In language we do not give heed to the position, shape, arrangement of the strokes that constitute the letter or the word, nor intrinsically to the sound of them, but to the interpretation to which they give rise. The language of stamps and flowers illustrate this point very well. On this account, perhaps, after we have mastered the details of spelling, we later get to be poor spellers: the meaning is uppermost, the formal content secondary. Thought utilizes language and removes the meaning one step farther: the meanings of words may now be represented by grotesque figures or fragmentary outlines of word as we have before

noted. So thought works hand in hand with language: the more highly developed and refined the expression, the more complex become the deliberative functions of thought processes. The genetic study of language demonstrates, especially in the child, the interdependence of thought and language at each step.

75. THE CONCEPT OR ABSTRACT IDEA.—Two different phases of the concept or abstract idea have been delineated: the one is made up principally of reproduced elements but now in fragmentary form, sometimes called representative; the other is constructed on the basis of systematic thinking, referred to as typical. An illustration of the first would be the concept of "tree" made up as it commonly is of remnants of experimental factors: trees we have seen, or one of the trees is taken as a sample for the lot. The outline may be hazy, the background dim or gray, few particulars may remain; or on the other hand a fairly definite tree, a certain elm or maple, may stand as an instance of the class. In the typical concept, however, like that of force, mind, immortality, duty, and the like, we have either the word as a verbal idea, or some bizarre imagery whose history may be explained, like that described in the opening paragraph, but which has come to stand for the meaning that is itself the fruit of thought. In both cases when generalization takes place, repeated features of successive instances that go to form the concept become schematized into some symbol which may also be verbal.

76. REASONING.—We may define reasoning as the function of mind which organizes experience. It differs from the organization which we discussed under attention and association in that it is the

conscious attempt at such organization directed toward the problems and objects of the environment, while the attentive and associative organization refers only to the order and arrangement of the mental processes and procedures themselves. Thinking is the more general term covering all forms of problem-solving in terms of ideational processes, sometimes accompanied by physiological tendencies. Reasoning is usually restricted to the more formal, step-wise process of meeting a puzzling situation. The stages of this procedure may be grouped into four. At the outset comes an interruption in the smooth course of events presenting a hindrance or difficulty in the adjustment of the individual to his environment. Then there is an apprehension, a scrutiny, and an analysis of the situation frequently involving a judgment of it. After that we find ourselves consciously referring to instances of previous experience, gathering data, comparing and relating facts and hypotheses, and arriving then at a tentative conclusion. The last stage consists of observing our conclusion at work and of modifying it to suit the circumstances that may develop.

77. JUDGMENT.—When a verdict is given to some problematic situation we have a judgment of it. The judgment may be an attributive phrase, "That is a good shot"; it may be a movement or gesture, like the look or nod of approval or "thumbs down"; or it may be entirely ideational, like the satisfaction with the commencement oration of a son. There always has been a tendency to find an outlet, as is evidenced by the uncomfortable feeling when refraining because of custom or regulation from giving applause at the end of a good organ selection splendidly played.

There are also many gradations of judgment from the immediate attachment of a phrase or idea to an experience, all the way to a decision reached after days and even months of deliberation. In most cases such attachment, consciously made, terminates a thought-process. The attachment of a meaning to a perception can hardly be called a judgment because the reference is not consciously made: it simply accrues. In the entire treatment of the thought-processes, it is difficult to keep on the psychological side of the boundary line. The various sciences have become better neighbors and have removed their fences so the children may sometimes be found playing on other peoples' lawns. Logic, or the discussion of the formal process of thinking, thus has become somewhat psychological; and the psychology of thought frequently overlaps logic.

78. SUMMARY.—Thought, the most complex functional process of mind, was found to be an attempt to discover a solution to problems of the environment that would not yield to the less complex processes of habituated consciousness. It normally consists of a series of processes, predominantly verbal, that are symbolically used and systematically arranged under the guidance of a latent "instruction" to find an answer. Sometimes the processes may drop out of clear attention and even give way to physiological processes. Occasionally observers have reported "imageless thoughts" and *conscious attitudes* that by others have been declared unanalyzable. When thought becomes definitely a matter of clear and sustained attention to the processes involved it is known as reasoning, of which four stages have been determined. The study of language is important in

this connection because it furnishes an illustration of the symbolic use of signs and sounds, a symbolism carried even a step further in the thought function, and because the development of language has a strong reciprocal effect on the development of thought in the human mind. Two phases of the abstract idea or concept were also outlined, illustrated, and discussed.

REVIEW QUESTIONS

1. What mental process closely resembles *thought*?
2. How are *thought* and *language* related?
3. Introspectively analyze your mental processes while undertaking to solve a problem.
4. Define *reasoning*, *judgment*, *conscious attitude*.
5. What is meant by the symbolic meaning of imagery in thought?

CHAPTER X

THE SELF

79. **THE SELF.**—The supreme organization of the individual mind leads at once to the *self*. There are two ways of considering this self. It is not impossible to conceive of an orderly arrangement of processes all genetically related to one another in the same psychophysical organism. By development and assimilation all the perceptions, ideas, emotions, actions, thought, and sentiments of an individual's mental life are more intimately related than are, for example, the ideas of one person with the ideas of another. At no time, of course, is an emotion, or an idea, or any other mental process entirely free from the remaining processes of mind in a single moment of consciousness; nor are the successive moments of consciousness free from each other. These are abstracted realities singled out under attention for the purpose of examination, as a spot-light isolates a part of the scenery. This concept of the *self* resolves itself into the meaning of the term *mind* except that it stamps *mind* with an individuality that is lacking in general treatment. The *self* is a particular mind in this sense. In a second sense it is the consciousness of one's own experience that is meant, although the more frequently used expression in this connection is self-consciousness. Other uses of the term in psychology savor of metaphysical and epistemological usage. The *self* can best be considered in the light of *an individual regarded as a progressively organized system of mental functions and processes*.

80. **PERSONALITY.**—It is difficult to define or even

to describe a term that has so many social, moral, and religious implications; but there is one point at which we are obliged to face the problem. We have seen how the self is organized in terms of the entire arrangement of functions and processes. In a later section we shall be prepared to consider types of mind that become disintegrated—split off into groups of processes. Since personality is largely the reflection of one's self in the social mirror, it is obvious that in the psychological sense the personality may alter slightly with the environment in which it finds itself. In Rome we do as the Romans do; everywhere we soon accommodate ourselves to our surroundings. Some individuals can make this accommodation more readily than others but we all do it to some extent. The writer has seen a group of college graduates of the class of 1855, at a commencement reunion, white-haired bankers, hard-headed business men, lawyers, and others, jubilantly acting like boys. They could hardly help doing so. All of us have different demeanors on different occasions. From the mental point of view it means that we have complete systems of associations together with the accompanying manners of behavior which fit various occasions and situations. We do not consciously assume professional mannerisms at one time and put on the characteristic behavior of home life at another time. These are usually habitually determined by the setting, even by the clothes we wear. A policeman is much less of a policeman after a mob has deprived him of part of his uniform. The soldier assumes the air of a soldier when he dons his regimentals. We scarcely realize, indeed, how much of our customary frame of mind is derived from such sources as the environment

furnishes. Mark how mind is upset when unexpected reversals leave it deserted of public and friendly confidence! But in spite of these variations in the theme of any individual mind there persists, of course, a continuous mental texture. It is the same fundamental composition throughout. Melodies may come and go, but the symphony of mind goes on to the end. In other words, while there may be groups and regroupings of mental processes, they are all related and integrated into one mind. This characteristic integration in any one case we call the personality, or self. When we discuss the total assemblage of associations on the side of process and function as consciously conceived, we refer to the *self*; when we regard this assemblage from the side of its reflection in environment and society, we term it the personality.

81. MULTIPLE OR ALTERED PERSONALITY.—We have seen how circumstances tend to influence the set or connection of mental processes, calling out some that are characteristic of the occasion and inhibiting others that conflict with it; and we have just remarked that there is nevertheless an undercurrent of continuous mental processes which unites all of these variations into one whole. After all, we can recall, under normal conditions, how we have behaved and misbehaved. But under stress of intense emotion and in a weakened mental condition it sometimes happens that the self or personality thus differentiated by the circumstance or occasion remains cut off or isolated from the rest of the mental complexes. Memories become grouped about each separate central experience and characteristic mannerisms attach themselves to each set of complexes. Physicians and psychopathologists have reported many

such cases in the scientific journals. One case that attracted public attention about ten years ago developed as many as five different personalities, most of them known by different given names, and some of them unconscious of the existence of the rest. One of the more prominent personalities represented a college girl of refinement and ability, the other a half-illiterate, almost vulgar, and mischievous girl who knew the weaknesses of the first and held them up for ridicule. The experiences of these different personalities suffered no cross-reference but attached themselves independently to the appropriate subject. This topic, belonging primarily to other provinces of general psychology than the one being treated in this book, has been introduced by way of exception and emphasis to the general rule of the development of personality.

82. CHARACTER.—Like personality the term *character* partakes of social and ethical considerations. The distinguishing marks and traits that society assigns to an individual in terms of his reactions to social conditions go to build up the character of the individual. Some of these traits—many of them habituated reactions, others inherent capacities,—are subject to specially devised tests. A summary of these tests in any individual case may under scientific conditions reveal in a serviceable manner the characteristics of the individual tested. But the attempt to delineate character through the analysis of handwriting, contours of head and face, posture, gait and the like, is unscientific, crude, and illogical. Much of it harks back to outworn doctrines. The logic involves the process of referring the characteristic of the generalization back to specific items. It is pos-

sible, for instance, to determine the average weight of a child at five years of age, but it would be ridiculous to say that every child weighing that much is five years old.

83. SOUL.—In the opening chapter it was indicated that at the present state of our knowledge it is not feasible to include this term in our psychological studies. With the word *soul* invariably come the connotations of individual responsibility, moral obligation, immortality, and similar considerations that are germane to the religious and philosophical studies and not amenable to scientific research. They are matters of value and not of fact. Mind ceases, according to our hypothesis, at death: beyond that we have no scientific method of approach. But most of us, however, still find solace in the religious disciplines because we believe that no one study can give a complete answer to the insistent problems of the universe. *Soul* must therefore in this study never be confused with *mind*.

84. PSYCHIC RESEARCH.—There is at present a considerable amount of discussion, especially in England and France, but lately also in this country, concerning the ability to communicate with individuals after death and with living ones through media that are not at present recognized by science. Societies have existed in this country and abroad, for several decades, for the purpose of studying these and kindred phenomena under the name of psychic research; but although large sums of money have been offered for scientific demonstration of these occurrences, no proof has been forthcoming. We cannot say, of course, that at this time we have the last word in print concerning everything that is to be known: the

account with truth is by no means closed and there is no indication that it will be closed in the immediate future. But science cannot give assent to any statement of alleged fact that will not stand the tests upon which science is itself founded. So we await proof.

85. SELF-CONSCIOUSNESS.—After disposing of these matters we come back to that examination of the self which is represented in consciousness. Concerning the question as to whether we are persistently or only intermittently conscious of ourselves there seem to be two conflicting answers: some psychologists say, "yes, we are persistently self-conscious", others say we are not. It is possible that those who speak affirmatively are either themselves extremely self-conscious or they confuse the philosophical implication of an ever present subject with the psychological fact of its existence in consciousness. It seems that the negative statement is nearer the truth of the matter; for on many occasions we are oblivious of our very existence, so thoroughly are we absorbed with the task in hand, with not even a trace of the conscious self in the background of attention.

The further question as to how, when we are conscious of ourselves, is the meaning of the self given, may be answered by direct evidence from both introspection and pathological cases. Some individuals carry the meaning in terms of a complex idea embodying a visual picture of their appearance, perhaps a portrait, together with the sound of their own voices and the like. But the most important constituents of self-consciousness are (1) the persistent group of organic sensations from within the body combined with tactual pressures, warmths, and oc-

casional pains, and (2) the continuous reference to one's past in terms of memorial and recognitive processes. In the abnormal cases it is frequently discovered that one or both of these contributing factors are responsible for alterations of personality or for total personal forgetfulness, technically known as *amnesia*. The individual either suffers some organic trouble which removes for the time being the impulses normally received from the vital organs of the abdomen and chest as well as from the muscles and skin, or a nervous shock breaks down the connections in the brain, so that he begins again with a comparatively clean slate: there is no connection with his previous experiences, and he is therefore a new person.

86. SUMMARY.—We have seen in the last analysis the possibility of a vast system of relations between all mental processes. Insofar as this system is different in each individual we term it the *self* as distinguished from the *mind* which represents the general designation for mental phenomena occurring between birth and death in any individual. The personality is the reflection of this self in the social and environmental mirror and is dependent on it, assuming different phases on different occasions. When these phases become so marked that they themselves become isolated units of organization, we have the conditions of multiple or altered personality. Character was treated as the sum total of traits assigned to an individual by society and measurable by tests but not by the gross methods commonly advertised in the press. *Soul* is disappearing from the serious writings of psychologists because of its religious and philosophical implications, and the attempts of psychic research to fathom the meaning of the unknown are not yet crowned with

the success that science has a right to expect of experimental procedures. In closing, we took the position that the individual is not continuously conscious of himself as distinct from his environment; that, when he is conscious of his own self, introspection shows the factors to consist largely of a background group of organic texture together with a reference to his own past experiences afforded by memorial and cognitive processes.

The writer may be granted the parting statement that perhaps at this time, after a careful though necessarily brief analysis of complex mental processes and functions, the promise made in the opening sections of the book has been fulfilled. At least the reader possesses a clearer notion of the task of psychological investigation, its point of view, and its results. With the description of mind now as complete as circumstances will permit, the definitions tentatively offered at the beginning ought to be more clearly understood; but they ought also to give way to the content that now stands of its own accord. They were but the scaffolding erected before the structure that represents our discussion, was completed. If the reader has taken a renewed interest in the phenomena of the mind and is able more to appreciate its operation and constitution, if he becomes keenly alive to things mental in himself and in others, the purpose of this brief book has been accomplished.

REVIEW QUESTIONS

1. Distinguish between *self*, *self-consciousness*, *soul*, *personality*, and *character*.
2. Explain multiple personality in terms of the phenomena of the normal mind.
3. Enumerate three ways in which your attitude toward psychology may have changed as the result of reading this text.
4. In what sense may the psychologist be legitimately interested in psychic research?
5. In the light of your reading, how would you describe the science of psychology to an inquiring friend?

APPENDIX A

THE INDUSTRIAL APPLICATIONS OF PSYCHOLOGY

APPLIED PSYCHOLOGY.—After a brief review of the rudiments of psychology, it will doubtless be of interest to outline the practical service which psychology can render mankind in his economic relationships and especially in commerce and industry. We have lately learned more emphatically than ever before the need of treating the human mind as though it were of some consequence in life. Out of the pure science of psychology, therefore, has grown up an extensive field of investigation and of accomplished results which might be designated "mental engineering." Applied psychology, its more usual name, has many branches that reach into the domains of legal practice and testimony, of medical treatment, of educational procedure, of social welfare, and even of artistic production. But probably the greatest endeavor at present lies in the direction of meeting industrial requirements and of improving business methods in general.

For some time it has been the practice for men working in other sciences to consult the psychologist concerning problems that had mental as well as physical aspects. But few people are aware that for some years prior to the Great War several large industries had psychologists on their pay roll and financially supported psychological research. One of the largest manufacturers of electric lamps and accessories regularly employed a psychologist, together with a physicist and a physiologist, to investigate problems of vision. A well equipped laboratory was provided for this purpose.

THE CONSULTING PSYCHOLOGIST.—But recently there have been more numerous calls for expert assistance in industries that began to realize the importance of taking mental factors into account. Manufacturers of high-grade tinted stationery saw the need of investigating problems of color discrimination, partial color blindness, and color weakness. In other industrial establishments skilled movements have been carefully analyzed by the moving-picture process with the purpose of selecting properly fitted individuals for the task or for the instruction of those who were to become skilled in the work. A group of professionally accredited psychologists have

organized a private corporation to undertake contracts especially for the mental examination and rating of the personnel of industrial concerns. Just as a firm of auditors will make a financial investigation of a corporation, so these psychologists will take a mental inventory of the industrial organization that requests it.

EXAMINATION OF PERSONNEL.—This particular field of investigation is now the forefront of applied psychology. It grew out of the needs of classifying the various occupations in the army. There was a good start in this direction before the war, but the last five years helped considerably to set the young discipline firmly on its feet. The governmental bulletin, "*Personnel*," is now being continued by the National Association of Employment Managers, and the entire method has been adapted to meet the civilian situation.

The choice of vocations presents two large requirements. There must be established a thoroughgoing *vocational selection*, or testing of candidates for any given trade or profession, or portion thereof, in order to reduce the wasteful and discouraging effect of the "labor turnover", and to eliminate "misfits". The technical requirements of the work must be carefully analyzed and checked with adequately standardized tests and the candidates selected substantially on this basis. At intervals examinations are set to afford an opportunity for subsequent rating. This applies to the entire personnel, from executive to workman. A still more difficult problem is that of *vocational guidance*, which involves the knowledge of the important requirements of a great many different trades and professions and the guidance of the individual into the line of work for which he is best fitted. On account of the enormous scope of this problem relatively less has been so far accomplished; but the work of testing men in a single profession in several instances compares very favorably with their actual success in the field.

GENERAL EFFICIENCY.—Also, in a large industrial organization, or retail concern, there are problems of mental efficiency which constantly demand attention, research, and solution. The educational needs of industries that recruit individuals from all walks of life and all parts of the globe, with many diverging interests and widely different mental constitutions, require psychological advice. There are also problems of social service and adjustment among the various groups. The

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morale of business is of the same importance in time of peace as the morale of an army in time of war; as the psychologists were needed in connection with the latter, so they are now demanded in connection with the former. Many of the avoidable but frequently dangerous mistakes that occur in business also have a mental basis.

SPECIAL PROBLEMS.—Finally we have to consider the special problems of buying, advertising, selling, and management. Of these perhaps advertising has invited the greatest attention on the part of our psychological laboratories. The general composition, position, size, frequency of appearance of advertising matter and many other related phases of the subject have been experimentally investigated with success. Some of our universities located in the larger industrial centers are continually called upon to solve problems of this sort. The results of positive and negative suggestion in advertising and selling have been of great value as have also the experimental investigation of special phases of memory, attention, and sentiment. The field of selling and of buying presents mental problems which the psychologist is now endeavoring to solve. And the most difficult question is that of analyzing all the complex factors which make the successful executive and manager; but even here psychology has made a promising beginning.

When it is realized that the entire staff of psychologists at one of our more prominent educational institutions of the country is devoting its entire time to the solution of mental problems in the industrial field, it can be understood why a brief discussion of the subject cannot here go into detail. But the references on the subject to fields of applied psychology, in the following bibliography, beckon those who care to study the matter with care.

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